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THE CANADIAN AIDS NAVIGATION SYSTEM

Please see important note on the next page





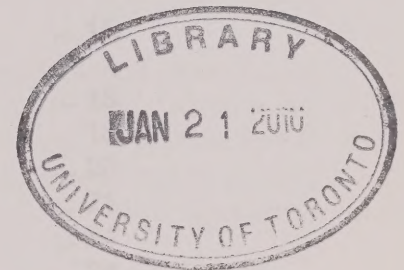
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2001



THE CANADIAN AIDS TO NAVIGATION SYSTEM



Navigation Systems Branch

Important Notice:

Responsibilities concerning the development of policy and the implementation, enforcement and administration of the Aids to Navigation Protection Regulations (repeal date: July 1, 2007 at which time this regulation will form part of the Canada Shipping Act, 2001). Private Buoy Regulations (PBR), Navigable Waters Protection Act (NWPA) and Boating Restriction Regulations have been transferred from the Department of Fisheries and Oceans Canada, Canadian Coast Guard to Transport Canada.

Therefore, it is to be understood that all references to the above noted legislations and/or regulations contained in this publication are now under the responsibility of Transport Canada and all enquiries concerning these acts and regulations must be directed to webfeedback@tc.gc.ca.

The Canadian Coast Guard, Aids to Navigation program will ensure this change in responsibility is reflected when future updates are made to each of its publications.

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Cap-des-Rosiers at sunset - Quebec; Michel Bouchard

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Goose Neck Island, Shoals range - St. Lawrence River - Ontario; Mac Peterson

False Duck Island, Solar station - Lake Ontario; Ted Cater

Prince Shoal Pier lightstation - St. Lawrence River - Quebec; Denis Chamard

Cape Salmon lightstation - St. Lawrence River - Quebec; Denis Chamard

Anchorage buoy - St. Lawrence River - Quebec; Michel Plamondon

Back Cover (l-r)

Ocean Vessel and Starboard buoy - St. Lawrence River - Quebec; Andre Boisvert

Minor fixed light - Beaver Point, Saltspring Island - B.C.; John Luzney

Small light buoy - Montreal - Quebec; Michel Plamondon

Unlighted Starboard Conical buoy - Punchbowl - Labrador; Maria DiSerio

Buoy Work - C.C.G.S. Montmagny - Montreal - Quebec; Michel Plamondon

PREFACE

The Canadian Coast Guard is pleased to release the 2001 edition of *The Canadian Aids to Navigation System* booklet. This edition replaces the 1995 edition as the new standard for aids to navigation in Canada.

As you will notice, there have been several improvements made to this edition. These changes include:

- a more "user friendly" format
- update of the *Private Buoy Regulations*
- update of long-range radio and satellite navigation technologies including Loran-C and GPS/DGPS
- update of Provincial contacts for *Boating Restriction Regulations*, regional Canadian Hydrographic Service offices and the Canadian Coast Guard offices
- update of the related publications and sources

The Coast Guard is confident that the changes made in this version provide the most comprehensive view possible of the Canadian aids to navigation system and greatly increase the value of this publication to the Canadian boating public.

NOTICES

1. Mariners are requested to immediately report any failure of a marine aid to navigation to the nearest Canadian Coast Guard office or to a Coast Guard Marine Communications and Traffic Services Centre.
2. On December 8, 1994, the US Department of Defense made available the Global Positioning System (GPS) for civilian use. This marine navigation system provides the capability to obtain horizontal positioning accuracy within 20 metres 95% of the time and 30 metres 99.99% of the time.

A method of obtaining greater accuracy from GPS is through a technique called Differential GPS (DGPS).

Coast Guard implemented the differential service nationally in 1996 and declared the DGPS service as providing a Full Operational Service (FOS) on May 28, 2000.

The Canadian DGPS service complements the United States Coast Guard system.

NOTE: See pages 44 to 46 for more information on the GPS/DGPS System.

3. It is not necessary to obtain the Coast Guard's permission to place or operate a private aids to navigation; however, all who propose to do so must ensure that such aids conform to both the Private Buoy Regulations and in cases where boating is restricted, the Boating Restriction Regulations (see page 50 for more information on the Owner's Guide to Private Aids to Navigation publication).

INTRODUCTION

GENERAL

Definition

Aids to Navigation are devices or systems, external to a vessel, which are provided to assist a mariner determine his position and course, to warn him of dangers or obstructions or to advise him of the location of the best or preferred route.

Responsibility

The Canadian Coast Guard is responsible for the provision of aids to navigation in Canadian waters with the exception of waterways such as the Trent-Severn and Rideau waterways, which are served by Parks Canada.

NOTE: A complete listing of Canadian Coast Guard Regional offices is included on pages 54 to 56.

Other Publications

For proper understanding and interpretation of their function, aids to navigation are to be used in conjunction with available marine publications including nautical charts, the *List of Lights, Buoys and Fog Signals*, the *Radio Aids to Marine Navigation* handbook and sailing directions. Information concerning nautical charts and sailing directions may be obtained from the Canadian Hydrographic Service, Department of Fisheries and Oceans. (See pages 53 for a complete listing of information sources).

The Canadian Aids to Navigation System

The Canadian aids to navigation system is a combined Lateral-Cardinal system. A knowledge of the characteristics of each of these basic types of aids is a prerequisite to the safe use of the system.

Lateral Aids to Navigation

Lateral aids may be in the form of either buoys or fixed aids. These aids indicate the location of hazards and of the safest or deepest water by indicating the side on which they are to be passed. The correct interpretation of lateral aids requires a knowledge of the direction of buoyage known as the "upstream direction". The upstream direction is the direction taken by a vessel when proceeding from seaward, toward the headwaters of a river, into a harbour or with the flood tide. In general, the upstream direction is in a southerly direction along the Atlantic Coast, in a northerly direction along the Pacific Coast and in an easterly direction along the Arctic Coast. In some waters the upstream direction is indicated on the charts by the use of lines and arrows.

When a vessel is proceeding in the upstream direction, starboard hand aids must be kept to starboard (right) and port hand aids must be kept to port (left).

Cardinal Aids to Navigation

Cardinal aids may be in the form of either buoys or fixed aids; however, at present, their use is confined to buoys in the Canadian system.

Cardinal aids indicate the location of hazards and of the safest or deepest water by reference to the cardinal points of the compass. There are four cardinal marks: North, East, South and West, which are positioned so that the safest or deepest water is to be found to the named side of the mark (e.g. to the north of a north cardinal mark).

Winter Navigation

In many parts of Canada winter ice conditions necessitate the removal of aids to navigation buoys and the closing of navigation. The operation of navigation lights and fog signals on shore may also be discontinued during such times. Some lights may also be replaced by lights of lower intensity.

In areas of less severe ice conditions the unlighted buoys used in summer may be left in place or lighted buoys may be replaced by more rugged, but unlighted, winter buoys where navigation continues. Mariners who use channels marked by such buoys before the official opening of the navigation season are cautioned that these aids may not be in their advertised positions due to storms and shifting ice.

Mariners are advised of the closing of navigation, of the seasonal removal or substitution of buoys, of the re-opening of navigational areas and positioning of buoys, and of the temporary discontinuance of other aids to navigation by local marine radio broadcasts, *Notices to Shipping*, and/or published *Notices to Mariners*.

Night Navigation

Most buoys and many land based aids are equipped with light reflective material. This reflective material is coloured to signify the type or lateral significance of the aid and, for buoys at close range, displays the identification numbers, letters or symbols. On lighted buoys this material serves as a back-up to the light.

The Canadian Coast Guard recommends that vessels depending on aids to navigation be equipped with searchlights to enable them to make use of this reflective material when necessary. It is recommended that large vessels be equipped with boat-mounted searchlights with at least 75,000 candela and that small vessels carry a hand-held searchlight with at least a 3 watt bulb and 6 volt battery with a nominal power of 4,000 candela.

Speed and Navigation

Canadian aids to navigation are designed and positioned in consideration of expected vessel speeds and thus, cannot be expected to perform up to expectations in situations involving excessive speed. The Canadian Coast Guard advises mariners to conform to local speed restrictions where applicable and to exercise good judgement in other situations.

Mariners are especially urged to reduce speed and proceed with caution under conditions of poor weather or visibility (including night navigation), in hazard or high traffic areas, or where ice has formed. Under these conditions, consideration must be given to the possibility of equipment failures, to limitations of the aids to navigation, and to reduced reaction times; problems which are only compounded by high speeds.

NOTE: Rule 6 of the *Collision Regulations, Canada Shipping Act* sets out guidelines relating to safe speed.

CAUTIONS IN THE USE OF AIDS TO NAVIGATION

1. Most aids to navigation are not under continuous observation and mariners should be aware that, with the many thousands of aids in Canada, failures and displacements do occur. The Coast Guard does not guarantee that all aids to navigation will operate as advertised and in the positions advertised at all times. Mariners observing lights out of operation or buoys, markers, etc., off charted position, damaged or missing are responsible for reporting such problems to the nearest Coast Guard Radio Station, Vessel Traffic Centre or Coast Guard office.
2. Aids to navigation are subject to damage, failure or dislocation by ice or storms, by being struck by vessels or tugs and by power failures. Ice and storm damage may be widespread and require considerable time to repair. Isolated damage may exist for a long time without being discovered and reported. Floating aids and pier lights in or near the water which are exposed to particularly rigorous strain during ice movement are at the greatest risk of damage and therefore, added caution is recommended in such situations.
3. Mariners are cautioned that buoys may fail to exhibit their advertised characteristics. Lights may be extinguished or sound signals may not function due to ice, collisions, mechanical failure and, in the case of bell and whistle buoys, calm water. The shape of a buoy may be altered by ice formation or damage. The colour of a buoy may be altered by freezing spray, marine growth or fouling by birds.
4. Mariners are cautioned not to rely solely on buoys for navigation purposes. Navigation should be by bearings or angles from fixed shore aids or other charted landmarks and by sounding or through use of satellite or radionavigation systems whenever possible.
5. The buoy positions shown on government charts should be considered only approximate positions. There are a number of limiting factors in accurately positioning buoys and their anchors, such as prevailing atmospheric and sea conditions, tidal and current conditions, seabed conditions and the fact that buoys are moored to anchors by varying lengths of chain and may drift about their charted positions within the scope of their moorings.
6. Since moving ice is liable to move buoys from their advertised positions, mariners should proceed with extreme caution under these circumstances.
7. Mariners are reminded that because of differences in horizontal datum (i.e. NAD 27, NAD 83), grids of charts of an area may vary from one chart to another. When plotting the positions of aids by the latitude and longitude method, the results should be checked against other available information.
8. In some instances where it is necessary to establish a buoy in close proximity to or on a navigational hazard (e.g., shoal, reef or ledge, etc.), the buoy symbol may be off-set slightly on the chart in the direction of the preferred navigable water so that the existing hazard depicted on the chart will not be overprinted by the buoy symbol. Such off-sets will be indicated on the chart by means of an arrow.

9. Mariners are cautioned not to navigate too closely to a buoy and risk collision with it, its mooring or with the underwater obstruction which it marks.
10. Many lights are equipped with sun switches that turn the lights off in daylight. These lights, both on shore and on most buoys, are unlit between sunrise and sunset. Mariners unable to see these lights during the daylight hours should not assume that the equipment is functioning abnormally.
11. At some lightstations, winter lights equipped with sun switches are operated when the main lights are decommissioned for the winter months. A winter light does not necessarily exhibit the same characteristics as the main light and has reduced intensity. The characteristics of a particular winter light and its season of operation are noted in the "Remarks" column of the *List of Lights, Buoys and Fog Signals*.
12. Many lightstations which exhibit the main light 24 hours per day are equipped with an emergency light which is brought into service automatically throughout the hours of darkness in the event of failure of the main light. These emergency lights are white and have a standard character of group flashing (6)15s. Emergency lights are normally (on a dark night with a clear atmosphere) visible at 5 nautical miles. The *List of Lights, Buoys and Fog Signals* publications identify which lightstations are equipped with emergency lights.
13. Atmospheric conditions can have a considerable effect on light transmission and the visibility of lights. For example:
 - (a) The distance of an observer from a light cannot be reliably estimated from its apparent brightness.
 - (b) At night it is difficult to distinguish between a white light and a yellow or blue light seen alone, except at a short distance.
 - (c) Under some atmospheric conditions white and yellow lights take on a reddish hue.
 - (d) Alternating lights with phases of different luminous intensity may change their apparent characteristics at different distances because some phases may not be visible.
 - (e) Weak lights are more easily obscured by conditions of low visibility than more powerful lights. Coloured lights are often of lower intensity than white lights and are more quickly lost under unfavourable circumstances.
 - (f) During cold weather, and more particularly with rapid changes of weather, ice, frost or moisture may form on the windows of lantern houses, thereby greatly reducing their visibility and possibly causing coloured lights to appear white.
 - (g) A light exhibiting a very short flash may not be visible at as great a range as a light exhibiting a longer flash.

14. The mariner should not rely solely on colour when using a sector light, but should verify the vessel's line of position by taking a bearing on the light. On either side of the line of demarcation, between white and red, and also between white and green, there is always a small arc of uncertain colour.
15. When the arc of visibility of a light is cut off by sloping land, the bearing at which it disappears or appears will vary with the observer's distance and height of eye.
16. The sighting of a light may be adversely affected by a strongly illuminated background.
17. In view of the varying distances at which a fog signal can be heard at sea, and the frequent occurrence of fog near, but not observable from, a fog signal station, mariners are cautioned that:
 - (a) While every endeavour will be made to start fog signals as soon as possible after signs of fog have been detected, they should not, when approaching the land in a fog, rely implicitly upon these fog signals, but should always take soundings, which, in nearly all cases, will give sufficient warning of danger.
 - (b) They should not judge their distance from a fog signal by the power of the sound. Under certain atmospheric conditions the sound may be lost at a very short distance from the station, and these conditions may vary within very short intervals of time. Mariners should not assume that a fog signal is not in operation because they do not hear it, even when in close proximity to it.
18. The visual aids to navigation (e.g. lights) provided by the Coast Guard are for the purpose of assisting marine navigation. Hunters, snowmobilers and ice fishermen are cautioned that aids to navigation installed for marine navigation purposes cannot be relied upon after the close of the marine navigation season. Such aids may stop operating without warning and will not be recommissioned by the Coast Guard until the next opening of marine navigation.

RELATED LEGISLATION

AIDS TO NAVIGATION PROTECTION REGULATIONS

Regulations have been enacted, under the *Canada Shipping Act*, to require anyone who accidentally damages an aid to navigation to report such occurrence to the Canadian Coast Guard and thus ensure the availability of the important service which they provide. These Regulations, which are called *Aids to Navigation Protection Regulations*, are as follows:

- "1. These Regulations may be cited as the Aids to Navigation Protection Regulations."
- "2. In these Regulations "aid to navigation" means a buoy, beacon, lighthouse, lightship or any other structure or device installed, built or maintained for the purpose of assisting the navigation of vessels."
- "3. (1) The person in charge of a vessel or tow that runs down, moves, damages or destroys an aid to navigation shall report the fact as soon as is practicable to the nearest Regional Director General or District Manager of the Canadian Coast Guard, Department of Fisheries & Oceans.

(2) Every person who fails to comply with subsection (1) is liable to a fine of \$200."

CRIMINAL CODE OF CANADA

Section 439 of the *Criminal Code of Canada* provides:

- "439. (1) Everyone who makes fast a vessel or boat to a signal, buoy or other seamark that is used for purposes of navigation is guilty of an offence punishable on summary conviction.
- The penalty is a fine of not more than \$2,000.00 or six months imprisonment or both.
- (2) Everyone who wilfully alters, removes or conceals a signal, buoy or other seamark that is used for purposes of navigation is guilty of an indictable offence and liable for imprisonment for a term not exceeding ten years."

PRIVATE BUOY REGULATIONS

The *Canada Shipping Act, Private Buoy Regulations* apply to all private buoys placed for the purpose of navigation or mooring with the exception of those which are used to mark fishing apparatus. These Regulations have been enacted to ensure that Canadian private buoys conform to accepted International and Coast Guard standards. In situations in which a private aid to navigation does not meet such standards Coast Guard is authorized to affect their removal or repair in accordance with the Regulations.

Very generally, the main principles of this Regulation include:

1. No person shall place or cause to be placed in any water a private buoy that interferes with or is likely to interfere with the navigation of any vessel, or misleads or is likely to mislead the operator.
2. No person shall place or cause to be placed, or maintain a private buoy unless all size, shape and identification requirements are met.
3. All private buoys must conform to those standards and guidelines as set out in *The Canadian Aids to Navigation System* (TP 968), as amended from time to time.
4. The Minister may require any change to be made to a private buoy, including an increase in minimum dimension or addition of retroreflective material, in any case where there is a need for improved visibility or better identification according to the requirements set out in the procedures manual for design and review of short-range aids to navigation system (TP9677), as amended from time to time.
5. Every private buoy and its mooring shall be constructed and maintained in such a manner and with such materials as will reasonably ensure that it will reliably remain in position and display its intended characteristics.
6. Every lighted buoy shall exhibit those light characteristics as required by Coast Guard and as specified in *The Canadian Aids to Navigation System* (TP 968) during the hours of darkness.

Under the *Canada Shipping Act*, persons failing to follow the legislated guidelines are liable on summary conviction to fines of up to \$200. In the event of an accident, private owners may also be found liable for any damages resulting from negligent operation and/or maintenance of the aid.

NOTE: Consult the full text of the Regulations for further details.

BOATING RESTRICTION REGULATIONS

Regulations have been enacted, under the *Canada Shipping Act*, to restrict the presence, activities, speed and engine size of boats on specified Canadian waters. These Regulations also define the prohibitions which apply to the construction, marking, placement, treatment and removal of authorized restrictive signs. The main principles include:

1. No person shall place or remove a sign which restricts the operation of any vessel in Canadian waters without first receiving authorization from the Minister of Transport.
2. No person shall alter, conceal, damage or destroy any authorized sign and shall not use such signs for mooring purposes.
3. No person shall operate a vessel in contravention of any restriction contained in an authorized sign unless exempt, as defined by the Regulations, or authorized by the Minister of Transport.
4. No person shall engage in any unauthorized activity, such as the staging of a regatta, boat race or marine parade, unless authorized by a permit issued pursuant to these Regulations.
5. No regatta, marine parade or boat race shall be held in a manner or at a place that would have the effect of unnecessarily obstructing ordinary navigation.
6. No person shall operate a commercial river raft unless authorized by a permit issued pursuant to the Regulations.
7. The Minister of Transport may authorize any party to place a sign in an area for the purpose of indicating that a restriction on the operation of vessels established by the Regulations exists in respect of that area, but may also cancel such authorizations and order removal if necessary.
8. Where a designated authority seeks the imposition of a restriction on navigation that is of the same nature as a restriction imposed by these Regulations, the authority may submit to the Minister of Transport a request for such a restriction together with any information regarding its implementation.
9. All those permitted and taking part in any activity under these Regulations must comply with all conditions set out in the permit.
10. All signs authorized under these Regulations must conform to the size and marking specifications as set out in the Regulations.
11. Any person who places an authorized sign is liable for all costs of construction, placing, maintenance and removal thereof and shall cause the sign to be maintained in the form and construction required by the Regulations.

12. A peace officer may question any person respecting any contravention or suspected contravention of these Regulations and may go on board any vessel for that purpose.
13. Every person who contravenes these Regulations is liable on summary conviction to a fine not exceeding \$500.

A complete listing of Provincial contacts for Boating Restriction information and permits is included at the end of this publication. For full details of these provisions consult the full text of Chapter 1407 of the *Canada Shipping Act, Boating Restriction Regulations*.

COLLISION REGULATIONS

These Regulations define the conduct which every vessel, in any water, must follow in order to avoid collision. Requirements for the carriage of navigation aids, such as lights and sounding appliances, guidelines detailing safe operation, and standards for the use of aids are also included.

It is of particular interest to mariners to note the similarities between these Regulations, other Coast Guard standards and common private practices in terms of light colours and flash characters. The following is a list of light requirements, under this Act, which may be confused with other standard lighting requirements (e.g. blue flashing lights are often used by private individuals for the purpose of marking harbour entrances; yellow flashing lights indicate the existence of special buoys).

NAME	DESCRIPTION	USAGE
Flashing Yellow	A yellow light in which a flash is regularly repeated at a frequency of 120 flashes per minute or more.	Air cushion vessels when operating in non-displacement mode.
Special Flashing Yellow	A yellow light flashing at regular intervals at a frequency of 50 to 70 flashes per minute.	Vessels being pushed.
Flashing Blue	A blue light in which a flash is regularly repeated at a frequency of 50 to 70 flashes per minute.	Any government or police vessel while engaged in duties.
Morse "U"	A white light in which two short flashes is followed by one long flash, the whole sequence being repeated two times per minute.	Stationary exploration or exploitation vessel.

Mariners should be knowledgeable with respect to the existence of these similarities and are urged to be aware of their presence on Canadian waters.

COAST GUARD AIDS TO NAVIGATION

By far, the most common owner/operator of aids to navigation in Canadian waters is the Canadian Coast Guard. Simply defined these include aids to navigation owned by the Canadian Coast Guard and any aid which is governed by a special agreement or partnership program with any other government agency in which Coast Guard retains operational and maintenance responsibilities.

Coast Guard and some other government aids to navigation are distinguishable from private buoys by their distinctive numbering-lettering system.

NOTE: See the sections on buoys and buoy numbering for more information on Coast Guard identification.

OTHER GOVERNMENT AIDS TO NAVIGATION

Other government agencies also establish aids to navigation or special purpose buoys or markers. These may include any Federal, Provincial, Municipal or other government agency, department, Crown Corporation or other authority. For example, the Department of National Defence, Parks Canada, Harbours and Port Commissions, and Ferry Corporations are current owners of aids to navigation.

When charted, these aids will normally not be identified as private aids as indicated by the letters "PRIV". When advertised in the *List of Lights, Buoys and Fog Signals* these aids will be identified by the name, address and telephone number of the owner.

PRIVATE AIDS TO NAVIGATION

GENERAL

In Canada it is permissible for private individuals, clubs, corporations or other groups to establish aids to navigation or mooring buoys for their own use. Such aids to navigation are known as "private aids" and those that are advertised in the *List of Lights, Buoys and Fog Signals* and on the charts are so identified. Private aids to navigation are defined as those aids to navigation or mooring buoys which are not operated by Federal or Provincial government or agency.

The Canadian Coast Guard recognizes the value of these aids in contributing to the safety and well-being of the boating community, particularly in areas where Coast Guard policy or resource limitations do not allow for aids to navigation service.

Although it is not necessary to obtain Coast Guard's permission to place or operate private aids, all private buoys must conform to the *Private Buoy Regulations*. Under these Regulations private buoys must not mislead, interfere with, or endanger any vessel and all must conform to the Coast Guard specifications for buoy identification and usage as set out in this manual. The *Private Buoy Regulations* apply to all private buoys placed for the purpose of navigation or mooring with the exception of those buoys which are used to mark fishing apparatus.

The *Private Buoy Regulations* have been enacted to ensure that private buoys are not a hazard to navigation and that they conform to accepted International standards. In situations in which a private buoy does not meet such standards, Coast Guard is authorized to order its repair. Where a private buoy interferes with, or misleads a mariner, the Coast Guard is authorized to affect its immediate removal. Under the *Canada Shipping Act*, persons failing to follow the legislated guidelines may be liable on summary conviction to fines of up to \$200.

In the event of an accident involving a private buoy, the person(s) owning that aid to navigation may be held liable for any damages resulting from negligent operation and/or maintenance of the buoy. Thus, owners are advised to take all necessary precautions to ensure that private buoys conform to Coast Guard standards and are operated and maintained in the proper manner. Where possible, shared operation under the auspices of a boating or other organization or the purchase of liability insurance is recommended.

NOTE: For further information regarding the ownership of a private buoy see the Canadian Coast Guard publication *An Owner's Guide to Private Aids to Navigation*. See listing on page 50.

MARKINGS AND DIMENSIONS

In the *Canada Shipping Act*, *Private Buoy Regulations*, all private buoys in Canada are required to conform to the aids to navigation standards set out herein. As such, all requirements for buoy identification and marking, apart from those relating to size and lettering, are described throughout this manual.

The *Private Buoy Regulations* require that private buoys meet minimum above water dimensions of 15.25 cm (6 inches) in width and 30.5 cm (12 inches) in height. This should be regarded as the absolute minimum, suitable only for very sheltered, low traffic areas. In general, the buoy should be large enough to be seen at the distance for which its signal can be interpreted to allow for timely action by the mariner. Consideration should be given to both adverse weather conditions and varying sea states. The *Private Buoy Regulations* allow the Coast Guard the authority to require buoys to be larger than the minimum, be equipped with retroreflective material, or be altered in any other way in the interest of safety (e.g. addition of lights, sound appliances, etc.) in accordance with prevailing site conditions.

The *Private Buoy Regulations* also require that buoys display, on two opposite sides, the capital letters "PRIV". These letters are to be as large as practical for the size of the buoy and contrasting in colour: white when the background colour is red, green or black, and black when the background colour is white or yellow. Additionally, the current name, address and telephone number of the owner of the buoy must be displayed in a permanent and legible manner.

If the owner of a private buoy wishes to place additional numbers or letters on a buoy for identification purposes, the number or letter system **MUST NOT** correspond to the letter and number system used by the Coast Guard in that immediate area. This serves to ensure that there is no confusion between Government operated aids, private aids and any other charted aids.

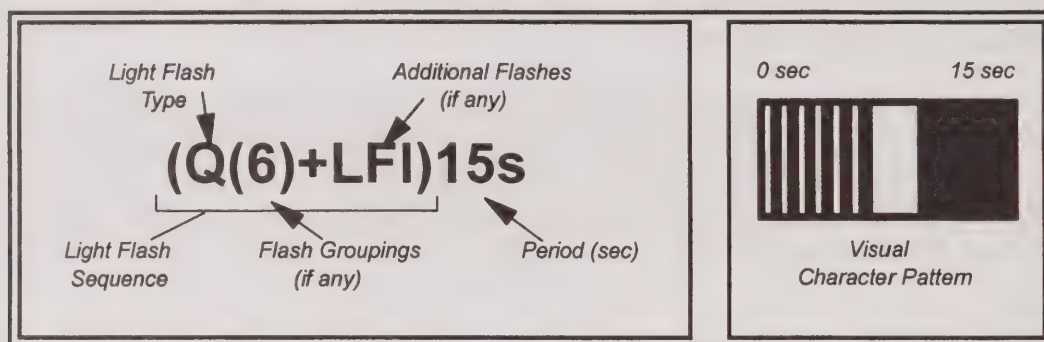
PUBLIC NOTIFICATION

When a private buoy(s) is placed in charted waters, it is desirable to provide Coast Guard with sufficient information to allow for publication of their positions and characteristics in marine notices (*Notices to Mariners; Notices to Shipping*) and for charting of the buoy(s) by the Canadian Hydrographic Service. Owners should also advise the nearest Coast Guard office of any changes to existing charted buoys.

CANADIAN LIGHT FLASH CHARACTERS

In Canada, all lighted aids to navigation, with the exception of those aids equipped with fixed (continuous) lighting, follow an established light flash character pattern. Such characters describe the periodic rhythm of a navigation light, thus enabling it to be identified on charts or while in visual contact.

A light flash character may be expressed as a series of letters and numbers which describe the operating characteristics of a particular light. The following provides an example of such a character as it might appear in the *List of Lights* or any other Coast Guard publication:



EXAMPLE:

In all cases, the first letter(s) in the light flash character gives reference to the general light flash type or classification. This classification is based on the duration of illumination in relation to eclipse (darkness) for each light flash. In the above example, the letter "Q" indicates that the aid is equipped with a quick flashing light; a quick flashing light being one which flashes at a rate of one flash per second.

Where a light exhibits group flashes, the second symbol in the character will indicate the number of flashes in each grouping. In the example above, the "(6)" indicates that flashes occur in groups of 6. Where the aid exhibits a single, ungrouped flash no value will be shown.

Any additional flash that may be included in the sequence will be indicated by the use of a "+" in the character followed by reference to an additional flash or flash grouping. For example, in the above illustration, the quick (Q) six flash grouping (6) is followed by a long flash (+LFI).

The final number in the light flash character identifies the period of time within which the entire flash sequence occurs. The 15s in the above character indicates that the entire flash sequence will be repeated every 15 seconds or 4 times every minute.

Once the entire light flash character is taken into account, the mariner should be able to correctly identify the aid (e.g. the example above is the light flash character for a South Cardinal buoy).

IALA MARITIME BOUYAGE SYSTEM

Bouyage Regions A and B, November 1980



BUOYS

The buoyage system used in Canada corresponds to the IALA (International Association of Lighthouse Authorities) Maritime Buoyage System which has been adopted by all of the major maritime nations in the world. This system includes lateral, cardinal, and special buoys.

For lateral buoys, the IALA Maritime Buoyage System divides the world into two regions, "A" and "B". Within Region "B", which comprises all of North and South America, Japan, the Republic of Korea and the Philippines, starboard hand buoys are red and port hand buoys are green. Within Region "A", which includes the rest of the world, the application of these colours is reversed (i.e. red to port and green to starboard). Bifurcation buoys are similarly affected in that the predominant colour of starboard bifurcation buoys is red in Region "B" and green in Region "A" and that of port bifurcation buoys is green in Region "B" and red in Region "A". All other aspects of the IALA Maritime Buoyage System are the same in both Regions "A" and "B".

Since the shape and/or colour of a buoy and the colour and flash character of the light on the buoy indicate the function of the buoy, it is essential that mariners use up-to-date nautical charts with this system.

NAVIGATION BUOYS

LATERAL BUOYS

Lateral buoys indicate the side on which they may be safely passed. There are six types of lateral buoys: port hand, starboard hand, port bifurcation, starboard bifurcation, fairway, and isolated danger.

Port Hand Buoy

- (a) A port hand buoy marks the port (left) side of a channel or the location of a danger which must be kept on the vessel's port (left) side when proceeding in the upstream direction.
- (b) A port hand buoy is coloured green, displays identification letter(s) and odd number(s) and
 - (i) if it carries a light, the light is green and is a flashing (Fl)4s or quick flashing (Q)1s light,
 - (ii) if it carries retroreflective material, such material is green,
 - (iii) if it does not carry a light, it has a flat top, and
 - (iv) if it carries a topmark, the topmark is a single green cylinder.

Starboard Hand Buoy

- (a) A starboard hand buoy marks the starboard (right) side of a channel or the location of a danger which must be kept on the vessel's starboard (right) side when proceeding in the upstream direction.
- (b) A starboard hand buoy is coloured red, displays identification letter(s) and even number(s) and
 - (i) if it carries a light, the light is red and is a flashing (Fl)4s or quick flashing (Q)1s light,
 - (ii) if it carries retroreflective material, such material is red,
 - (iii) if it does not carry a light, it has a pointed (conical) top, and
 - (iv) if it carries a topmark, the topmark is a single red cone, point upward.

Port Bifurcation Buoy

- (a) A port bifurcation buoy marks the point where a channel divides when viewed from a vessel proceeding in the upstream direction and indicates that the preferred or main channel is on the starboard (right) side of the buoy.
- (b) A port bifurcation buoy is coloured green with one broad red horizontal band, displays identification letter(s), and
 - (i) if it carries a light, the light is green and is a composite group flashing Fl(2+1)6s or Fl(2+1)10s light,
 - (ii) if it carries retroreflective material, such material is green,
 - (iii) if it does not carry a light, the top of the buoy is flat, and
 - (iv) if it carries a topmark, the topmark is a single green cylinder.

Starboard Bifurcation Buoy

- (a) A starboard bifurcation buoy marks the point where a channel divides when viewed from a vessel proceeding in the upstream direction and indicates the preferred or main channel is on the port (left) side of the buoy.
- (b) A starboard bifurcation buoy is coloured red with one broad green horizontal band, displays identification letter(s), and
 - (i) if it carries a light, the light is red and is a composite group flashing Fl(2+1)6s or Fl(2+1)10s light,
 - (ii) if it carries retroreflective material, such material is red,
 - (iii) if it does not carry a light, the top of the buoy is conical, and
 - (iv) if it carries a topmark, the topmark is a single red cone, point upward.

Fairway Buoy

- (a) A fairway buoy indicates safe water. Used to mark landfalls, channel entrances or the centre of a channel. It may be passed on either side but should be kept to the port (left) when proceeding in either direction.
- (b) A fairway buoy is coloured red and white in wide vertical stripes of equal widths, displays identification letter(s), and
 - (i) if it carries a light, the light is white and is either a Morse "A" Mo(A)6s light or a long flash (LFI)10s light,
 - (ii) if it carries retroreflective material, such material is white,
 - (iii) if it does not carry a light, the top of the buoy is spherical, and
 - (iv) if it carries a topmark, the topmark is a single red sphere.

Isolated Danger Buoy

- (a) An isolated danger buoy is moored on, or above, an isolated danger which has navigable water all around it.
- (b) An isolated danger buoy is black with one broad red horizontal band, displays identification letter(s), and
 - (i) if it carries a light, the light is white and a group flashing Fl(2)5s or Fl(2)10s light,
 - (ii) if it carries retroreflective material, such material is white,
 - (iii) if it does not carry a light, it is normally spar shaped although other shapes may be used, and
 - (iv) if it carries a topmark, the topmark is two black spheres, one above the other.

CARDINAL BUOYS

Cardinal buoys indicate the location of the safest or deepest water by reference to the cardinal points of the compass. There are four cardinal buoys: North, East, South and West.

If a cardinal buoy carries retroreflective material, such material is white. Where lights are not present, the cardinal buoy will normally be spar shaped although other shapes may be used.

North Cardinal Buoy

- (a) A north cardinal buoy is located so that the safest water exists to the north of it.
- (b) A north cardinal buoy is coloured black and yellow in approximately equal areas above the waterline, the top half of the buoy being black and the lower half being yellow. It displays identification letter(s) and
 - (i) if it carries a light, the light is white and is a quick flashing (Q)1s or very quick flashing (VQ)5s light, and
 - (ii) if it carries a topmark, the topmark is two black cones, one above the other, points upward.

East Cardinal Buoy

- (a) An east cardinal buoy is located so that the safest water exists to the east of it.
- (b) An east cardinal buoy is coloured black with one broad yellow horizontal band. It displays identification letter(s) and
 - (i) if it carries a light, the light is white and is a group quick flashing three Q(3)10s or a group very quick flashing three VQ(3)5s light, and
 - (ii) if it carries a topmark, the topmark is two black cones, one above the other, base to base.

South Cardinal Buoy

- (a) A south cardinal buoy is located so that the safest water exists to the south of it.
- (b) A south cardinal buoy is coloured black and yellow in approximately equal areas above the waterline, the top half of the buoy being yellow and the lower half being black. It displays identification letter(s) and
 - (i) if it carries a light, the light is white and is a group quick flashing six plus long flash (Q(6)+LFI)15s light or group very quick flashing six plus long flash (VQ(6)+LFI)10s light, and,
 - (ii) if it carries a topmark, the topmark is two black cones, one above the other, points downward.

West Cardinal Buoy

- (a) A west cardinal buoy is located so that the safest water exists to the west of it.
- (b) A west cardinal buoy is coloured yellow with one broad black horizontal band. It displays identification letter(s) and
 - (i) if it carries a light, the light is white and is a group quick flashing nine Q(9)15s light or a group very quick flashing nine VQ(9)10s light, and
 - (ii) if it carries a topmark, the topmark is two black cones, one above the other, point to point.

SPECIAL BUOYS

Special buoys are used to convey, a variety of information to the mariner, which while important, is not primarily intended to assist in the navigation of the vessel. The shapes of special buoys have no significance and a variety of shapes may be used in practice.

Many special buoys are privately owned. As required by the *Private Buoy Regulations* such buoys must display the letters "PRIV" as well as the owner's name, address and telephone number. They will not display numbers or letters conforming to the Coast Guard identification system.

In cases where special buoys display retroreflective material, such material will reflect the same colour as that of its required markings (e.g. keepout buoys are identified by an orange symbol, thus, the retroreflective material will also be orange). Where no colour is required (i.e. white swimming and diving buoys) retroreflective material will display yellow.

Regardless of the colour of reflective material, all special buoys, where lighted, will display yellow lights. With the exception of ODAS buoys, these lights will be flashing (Fl)4s, meaning that they will flash regularly at intervals of 4 seconds each. ODAS Buoys, if lighted, will also carry yellow lights but will display a group flashing character of 5 flashes every 20 seconds, Fl(5)20s.

NOTE: Keepout and Control buoys are governed by the *Canada Shipping Act, Boating Restriction Regulations*. ODAS and Diving buoys are governed by the *Canada Shipping Act, Collision Regulations*.

Anchorage Buoy

- (a) An anchorage buoy marks the perimeter of a designated anchorage area.
- (b) An anchorage buoy is coloured yellow, displays a black anchor symbol on at least two opposite sides, displays identification letter(s), and if it carries a topmark, the topmark is a single yellow "X" shape.

Cautionary Buoy

- (a) A cautionary buoy marks an area where mariners are to be warned of dangers such as firing ranges, racing courses, seaplane bases, underwater structures or aquaculture, of areas where no safe through channel exists, and of traffic separations. The mariner must consult his chart to determine the precise nature of the danger being marked.
- (b) A cautionary buoy is coloured yellow, displays identification letter(s) and if it carries a topmark, the topmark is a single yellow "X" shape.

Control Buoy

- (a) A control buoy marks an area where boating is restricted.
- (b) A control buoy is coloured white and has an orange, open-faced circle on two opposite sides and two orange horizontal bands, one above and one below the circles. A black figure or symbol inside the orange circles indicates the nature of the restriction in effect. It may display identification letter(s).

Diving Buoy

- (a) A diving buoy marks an area where scuba or other such diving activity is in progress.
- (b) A diving buoy is coloured white and carries a red flag not less than 50 centimetres square with a white diagonal stripe extending from the tip of the hoist to the bottom of the fly. It may display identification letter(s) and if it carries retroreflective material, such material is yellow.

Hazard Buoy

- (a) A hazard buoy marks random hazards such as rocks, shoals or turbulent waters located outside the main channel.
- (b) A hazard buoy is coloured white and has an orange diamond on two opposite sides and two orange horizontal bands, one above and one below the diamond symbols. Information words or symbols concerning the hazard may be placed within the diamond symbol, or if space doesn't permit, between the orange bands. It may also display identification letter(s).

Information Buoy

- (a) An information buoy displays, by means of words or symbols, information of interest to the mariner.
- (b) An information buoy is coloured white and has an orange, open-faced square symbol on two opposite sides and two orange horizontal bands, one above and one below the square symbols. The information words or symbols are black and are placed within the white face of the square symbol. It may display identification letter(s).

Keepout Buoy

- (a) A keepout buoy marks an area where boats are prohibited.
- (b) A keepout buoy is coloured white and has an orange diamond containing an orange cross on two opposite sides and two orange horizontal bands, one above and one below the diamond symbols. It may display identification letter(s).

Mooring Buoy

- (a) A mooring buoy is used for mooring or securing a vessel, seaplane, etc.
- (b) A mooring buoy is coloured white and orange, the orange colour covering the top one-third of the buoy above the waterline. It may display identification letter(s).

Ocean Data Acquisition System (ODAS) Buoy

- (a) An ODAS buoy marks a scientific, meteorological or oceanographic station.
- (b) An ODAS buoy shall not exhibit a shape that conflicts with any navigational mark.
- (c) An ODAS buoy is coloured yellow, displays identification letter(s) and
 - (i) if it carries a light, the light is yellow and is a group flashing light of 5 flashes every 20 seconds, Fl(5)20s, and
 - (ii) if it carries a topmark, the topmark is a single yellow "X" shape.

Swimming Buoy

- (a) A swimming buoy marks the perimeter of a swimming area.
- (b) A swimming buoy is coloured white, and may display identification letter(s)

DAYTIME IDENTIFICATION

During daytime, the colour and shape of a buoy indicate the buoy type and hence its function and interpretation by the mariner.

Buoy Colour

The following are the buoy colours used in the Canadian Buoyage System:

BUOY TYPE	COLOUR
Port	Green
Starboard	Red
Fairway	Red and White vertical stripes
Isolated Danger	Black with one broad horizontal Red band
Port Bifurcation	Green with one horizontal Red band
Starboard Bifurcation	Red with one horizontal Green band
North Cardinal	Black above Yellow
East Cardinal	Black with one broad horizontal Yellow band
South Cardinal	Yellow above Black
West Cardinal	Yellow with one broad horizontal Black band
Anchorage Cautionary ODAS	Yellow
Mooring Keepout Control Hazard Information	White with Orange symbols
Swimming	White
Diving	White with Red and White flag

Buoy Shape

The shape of an unlighted buoy indicates the position of the buoy with respect to the channel and thus the side on which the buoy should be passed:

- (a) A pointed (conical) shape indicates that the buoy is marking the starboard (right) side of the channel or the location of a danger which must be kept on the vessel's starboard (right) side when proceeding upstream.
- (b) A flat top or cylindrical (can) shape indicates that the buoy is marking the port (left) side of the channel or the location of a danger which must be kept on the vessel's port (left) side when proceeding upstream. Flat topped (can) buoys are also used for some applications where the shape of the buoy has no significance (for example, special buoys and (rarely) cardinal buoys). In the placement of such buoys, care is taken not to convey an unsafe message in the event that the meaning of the buoy is interpreted by shape only.
- (c) A spherical shape indicates that the buoy is marking the centre of the channel or safe water and that it may be safely passed on either side although generally it should be kept on the vessel's port (left) side when proceeding in either direction.

Topmarks

The use of topmarks as an additional means of daytime buoy identification is at present, restricted to lateral and cardinal buoys in ice-free conditions. Topmarks are not used in Canada to the extent that they are used in other parts of the world because of the environmental conditions which Canadian aids to navigation must endure. Mariners are cautioned not to rely solely on topmarks as a means of buoy identification as they are susceptible to damage and may be intentionally removed during winter and ice conditions.

However, the Canadian Buoyage System includes topmarks for each buoy as follows:

BUOY TYPE	TOPMARK DESCRIPTION
Port and Port Bifurcation	Single Green cylinder
Starboard and Starboard Bifurcation	Single Red cone, point upward
Fairway	Single Red sphere
Isolated Danger	2 Black spheres, one above the other
North Cardinal	2 Black cones, points upward
East Cardinal	2 Black cones, base to base
South Cardinal	2 Black cones, points downward
West Cardinal	2 Black cones, point to point

NOTE: A way of remembering the arrangement of the conical topmarks on Cardinal Buoys is to relate the direction of the points of the cones to the location of the black portion(s) of the buoy (e.g. on an East Cardinal, the upper cone pointing up and the lower cone pointing down relate to the black colour of the upper and lower portions of the buoy).

NIGHTTIME IDENTIFICATION

At night, the colour and flash character of a buoy light indicate the buoy type and hence its function and interpretation by the mariner.

Buoy Light Flash Characters

The following are the names, abbreviations and descriptions of the flash characters of the lights used in the Canadian Buoyage System:

NAME	ABBREVIATION	DESCRIPTION	BUOY
Flashing	Fl	A light in which a 0.5 second flash is regularly repeated at a rate of 15 flashes per minute (one flash every 4 seconds)	Port Starboard Anchorage Cautionary Mooring Keepout Control Hazard Information Swimming Diving
Quick Flashing	Q	A light in which a 0.3 second flash is regularly repeated at a rate of 60 flashes per minute (one flash every second)	Port Starboard North Cardinal
Very Quick	VQ	A light in which a flash is regularly repeated at a rate of 120 flashes per minute (a flash every 1/2 second)	North Cardinal
Morse "A"	Mo(A)	A light in which a 0.3 second flash is followed by a 0.6 second eclipse then a one second long flash repeated at a rate of 10 times per minute (every 6 seconds)	Fairway
Long Flash	LFI	A light in which a flash of 2 seconds duration is repeated at a rate of 6 flashes per minute (one flash every 10 seconds)	Fairway
Group Flashing (2)	Fl(2)5s	A light in which a group of 2 flashes is regularly repeated 12 times per minute (every 5 seconds)	Isolated Danger
	OR Fl(2)10s	A light in which a group of 2 flashes is regularly repeated 6 times per minute (every 10 seconds)	

Composite Group Flashing	FI(2+1)6s	A light in which a group of 2 flashes is followed by a single flash, the whole sequence being repeated 10 times per minute (every 6 seconds)	Port and Starboard Bifurcation
OR			
	FI(2+1)10s	A light in which a group of 2 flashes is followed by a single flash, the whole sequence being repeated 6 times per minute (every 10 seconds)	
Group Quick Flashing (3)	Q(3)10s	A quick flashing light in which a group of 3 flashes is regularly repeated 6 times per minute (every 10 seconds)	East Cardinal
Group Very Quick Flashing (3)	VQ(3)5s	A very quick flashing light in which a group of 3 flashes is regularly repeated 12 times per minute (every 5 seconds)	East Cardinal
Group Quick Flashing (6) + Long Flash	(Q(6)+ LFI)15s	A light in which a group of 6 quick flashes is followed by a single long flash, the whole sequence being regularly repeated 4 times per minute (every 15 seconds)	South Cardinal
Group Very Quick Flashing (6) + Long Flash	(VQ(6)+ LFI)10s	A light in which a group of 6 very quick flashes is followed by a single long flash, the whole sequence being regularly repeated 6 times per minute (every 10 seconds)	South Cardinal
Group Quick Flashing (9)	Q(9)15s	A quick flashing light in which a group of 9 flashes is regularly repeated 4 times per minute (every 15 seconds)	West Cardinal
Group Very Quick Flashing (9)	VQ(9)10s	A very quick flashing light in which a group of 9 flashes is regularly repeated 6 times per minute (every 10 seconds)	West Cardinal
Group Flashing (5)	FI(5)20s	A light in which a group of 5 flashes is regularly repeated 3 times per minute (every 20 seconds)	ODAS

NOTE: As a way of remembering the light flash characters of the East, South and West Cardinal buoys, the number of flashes in each group for these lights is the same as the figure on the clock face in the corresponding compass direction (e.g. the 3 flashes in each group for the East cardinal corresponds to three o'clock). The long flash in the South Cardinal character ensures that there is no confusion between the 6 flashes per group of this buoy and the 9 flashes per group of the West Cardinal.

Buoy Light Colour

The following are the colours of the buoy lights used in the Canadian Buoyage System:

BUOY TYPE	LIGHT COLOUR
Port and Port Bifurcation	Green
Starboard and Starboard Bifurcation	Red
Fariway, Isolated Danger, and all Cardinals	White
All Special buoys	Yellow

Retroreflective Material

Retroreflective material is applied to unlighted buoys to aid in their nighttime identification with a flashlight or other light source and to lighted buoys as a back-up to the light. For all buoys other than special buoys the colour of the retroreflective material is the same as that of the light which would be appropriate for each buoy. In cases where a special buoy is equipped with retroreflective material for use with number or letter plates/backgrounds, the colour of that material will be yellow. Additionally, where a buoy exhibits an orange symbol (e.g. Hazard), orange retroreflective material may be added to enhance visibility of the symbol.

NOTE: Swimming and diving buoys, which are white in colour, will use yellow retroreflective material.

OTHER CHARACTERISTICS

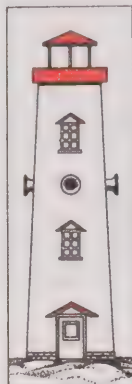
Buoy Numbering

Only starboard and port hand buoys are numbered; starboard hand buoys with even numbers and port hand buoys with odd numbers. Buoy numbers increase in the upstream direction and are kept in approximate sequence on both sides of the channel by omitting numbers where required. Buoy numbers are usually preceded by one or two letters to facilitate channel identification. All other types of buoys are identified by letters only. All types of buoys may be identified by a name in addition to a number or letter identification. Private buoys are not numbered or lettered as are Coast Guard buoys. Instead, they display the letters "PRIV" and other information required by the *Private Buoy Regulations*.

THE CANADIAN AIDS TO NAVIGATION SYSTEM

Canada

LIGHTSTATION



LIGHT —

A LIGHTSTATION IS A MAJOR AID TO NAVIGATION THAT DISPLAYS A MAIN LIGHT, IS EQUIPPED WITH AN EMERGENCY LIGHT, AND MAY BE EQUIPPED WITH A FOG SIGNAL, RADIO BEACON OR RACON.

LIGHT COLOUR AND CHARACTER ARE ADVERTISED ON THE CHART AND IN THE PUBLICATION "LIST OF LIGHTS, BUOYS AND FOG SIGNALS". STRUCTURE COLOUR MAY NOT HAVE LATERAL SIGNIFICANCE. ELEVATION OF LIGHT ABOVE WATER LEVEL [METRES (m) OR FEET (ft)] AND NOMINAL RANGE [NAUTICAL MILES (M)] MAY BE INDICATED. EQUIPPED WITH AN EMERGENCY LIGHT OF REDUCED INTENSITY, FIG16s. WHEN LIGHT COLOUR IS NOT SPECIFIED FOR ANY MARINE AIDS NAVIGATION LIGHT, IT IS WHITE.

FOG

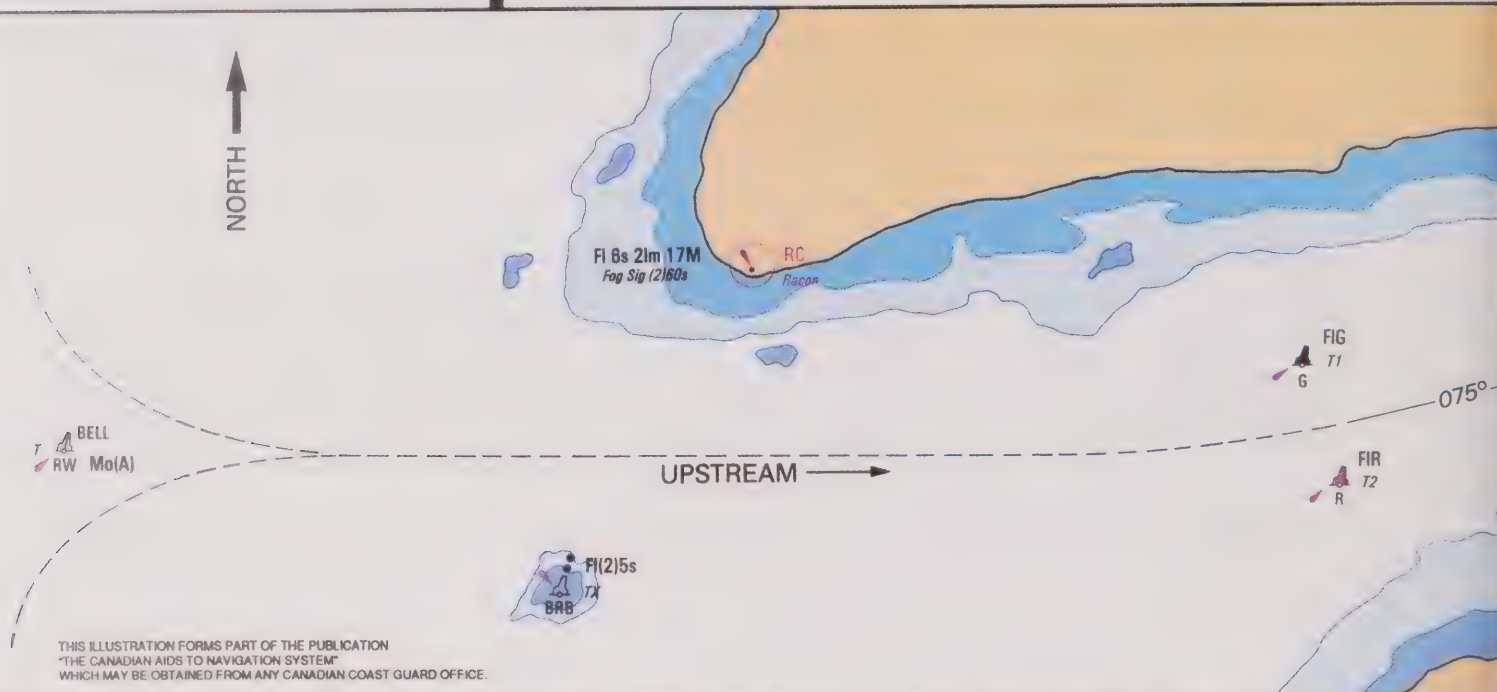
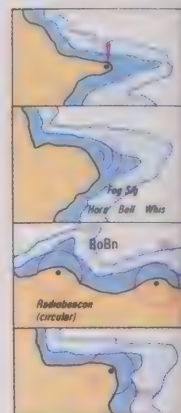
SIGNAL — SIGNAL CHARACTERISTICS ADVERTISED ON CHART AND IN "LIST OF LIGHTS, BUOYS AND FOG SIGNALS".

RADIO

BEACON — INFORMATION CONCERNING RADIO BEACONS CAN BE FOUND IN THE PUBLICATION "RADIO AIDS TO MARINE NAVIGATION." VESSELS MUST BE EQUIPPED WITH RADIO DIRECTION FINDING RECEIVERS TO USE THESE AIDS.

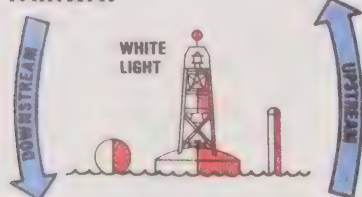
RACONS —

A RACON (RADAR BEACON) TRANSMITS A MORSE CODE PULSE THAT CAN BE SEEN ON A RADAR DISPLAY DISTINGUISHING IT FROM SURROUNDING RADAR TARGETS. INFORMATION CONCERNING RACONS CAN BE FOUND IN "RADIO AIDS TO MARINE NAVIGATION".



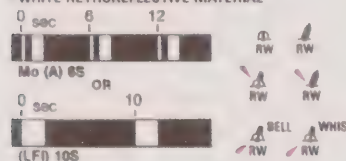
LATERAL BUOYS

FAIRWAY



DESCRIPTION

- RED & WHITE VERTICAL STRIPES
- WHITE LIGHT M₀(A) 8s OR (LF) 10s (IF EQUIPPED)
- IF UNLIGHTED, IT HAS A SPHERICAL TOP
- RED SPHERICAL TOPMARK (IF EQUIPPED)
- LETTERED — NO NUMBERS
- WHITE RETROREFLECTIVE MATERIAL



USERS' GUIDE

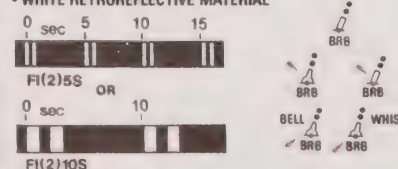
THIS BUOY INDICATES SAFE WATER. USED TO MARK LANDFALLS, CHANNEL ENTRANCES OR CHANNEL CENTERS. IT MAY BE PASSED ON EITHER SIDE BUT SHOULD BE KEPT TO THE PORT (LEFT) WHEN PROCEEDING IN EITHER DIRECTION.

ISOLATED DANGER



DESCRIPTION

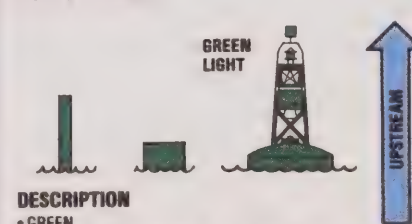
- BLACK WITH ONE RED HORIZONTAL BAND
- WHITE LIGHT, GROUP F(2) 5s OR GROUP F(2) 10s (IF EQUIPPED)
- TWO BLACK SPHERICAL TOPMARKS
- LETTERED — NO NUMBERS
- WHITE RETROREFLECTIVE MATERIAL



USERS' GUIDE

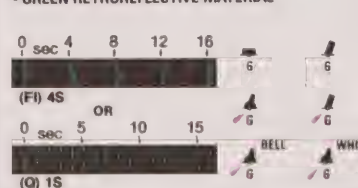
AN ISOLATED DANGER BUOY IS MOORED ON, OR ABOVE, AN ISOLATED DANGER WHICH HAS NAVIGABLE WATER ALL AROUND IT. CONSULT THE CHART FOR INFORMATION CONCERNING THE DANGER, (DIMENSIONS, DEPTH ETC.). MAY BE USED TO MARK NATURAL DANGERS SUCH AS SMALL SHOALS OR OBSTRUCTIONS SUCH AS WRECKS.

PORT HAND



DESCRIPTION

- GREEN
- GREEN LIGHT (F) 4s OR (Q) 1s (IF EQUIPPED)
- IF UNLIGHTED, IT HAS A FLAT TOP
- TOPMARK IS A SINGLE GREEN CYLINDER (IF EQUIPPED)
- LETTER(S) AND ODD NUMBER(S)
- GREEN RETROREFLECTIVE MATERIAL



USERS' GUIDE

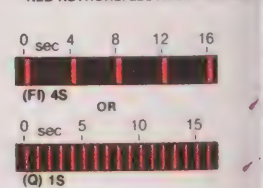
A PORT HAND BUOY MARKS THE PORT (LEFT) SIDE OF A CHANNEL OR THE LOCATION OF A DANGER WHICH MUST BE KEPT ON THE VESSEL'S PORT (LEFT) SIDE WHEN PROCEEDING IN THE UPSTREAM DIRECTION

STARBOARD



DESCRIPTION

- RED
- RED LIGHT (FI) 4s OR (Q) 1s (IF EQUIPPED)
- IF UNLIGHTED, IT HAS A POINTED CONE OF VISION
- TOPMARK IS A SINGLE RED CONE, POINTING UPWARD (IF EQUIPPED)
- LETTER(S) AND EVEN NUMBER(S)
- RED RETROREFLECTIVE MATERIAL

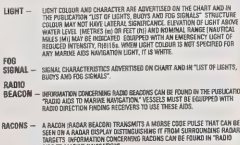


USERS' GUIDE

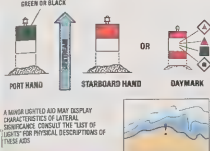
A STARBOARD HAND BUOY MARKS THE (RIGHT) SIDE OF A CHANNEL OR THE A DANGER WHICH MUST BE KEPT ON STARBOARD (RIGHT) SIDE WHEN PRI THE UPSTREAM DIRECTION

RANGES

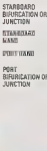
A LIGHTSTATION IS A MAJOR AID TO NAVIGATION. LIGHT IS EQUIPPED WITH AN EMERGENCY LIGHT WITH A FOG SIGNAL, RADIO BEACON OR RACON.



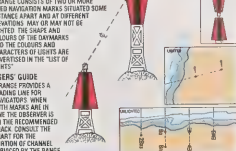
MINOR LIGHTED AIDS



DIRECTIONAL



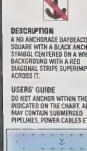
ANGES



SECTOR LIGHTS



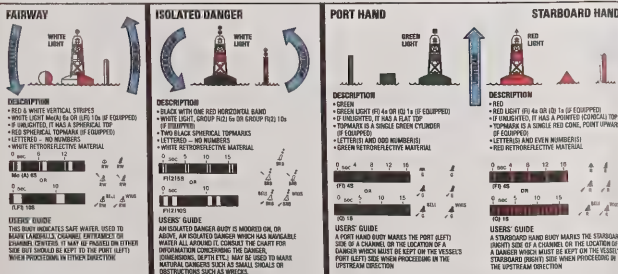
NO ANCHORAGE



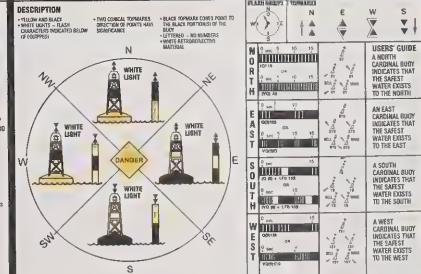
STANDARD DAYBEACONS



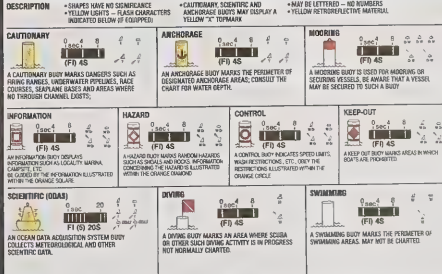
LATERAL BUOYS



CARDINAL BUOYS



SPECIAL BUOYS



Sound

Any of the buoy types in the Canadian Buoyage System may be fitted with a bell or a whistle that is activated by the motion of the buoy in the water. The use of such buoys is generally restricted to coastal waters where there is sufficient buoy motion to activate the sound device and where there is a requirement for an audio signal to enable location of the buoy under low visibility conditions.

Radar Reflectors

Many buoys are fitted with radar reflectors to improve their visibility on the radar screen.

Radar Beacons (RACONS)

When precise identification of a buoy is considered essential, the buoy may be fitted with a radar beacon (RACON). See page 35 for a further explanation of these devices.

Marking of New Dangers

New dangers such as a shipwreck or the discovery of an uncharted shoal or rock can occur suddenly and unexpectedly in waters which mariners have come to regard as safe. The Canadian Buoyage System makes the following special provisions for these hazards:

- (a) One or more of the buoys marking the new danger may be duplicated, the duplicate being identical to its partner in all respects.
- (b) In general, any lighted lateral or cardinal buoy used to mark a new danger will display the most rapid flash character available for that buoy.
- (c) A new danger may be marked by a RACON coded Morse "D".
- (d) Special measures taken to mark a new danger may be discontinued when information concerning the new danger has been sufficiently promulgated.

FIXED AIDS TO NAVIGATION

GENERAL

The characteristics of fixed aids are for identification purposes. They consist of the light colour and flash character by night and the colour and shape of the structure by day (daymark), as advertised in the appropriate *List of Lights, Buoys and Fog Signals* publication.

LIGHTED FIXED AIDS

General

Lighted fixed aids are structures equipped with a light and located at prominent sites to assist the mariner to fix his position. They may be at or near shorelines or on built-up, man-made piers in or near waterways. The structure and colour(s) of lighted fixed aids are often selected for maximum visibility and ease of identification and may or may not have lateral significance.

Types

The types and shapes of fixed, lighted structures used in Canada are varied. They may have vertical or tapering sides, may be circular, square, polygonal or octagonal in section, and may be constructed of wood, masonry, concrete, metal or fibreglass. They may be slender cylindrical structures such as pipes or poles or open skeleton towers.

Lightstations are coastal landfall lights that have distinctive characteristics to assist the mariner in determining his exact location.

Minor lighted aids are fixed marks which indicate position or warn of dangers. Typically, minor lighted aids which display a single red, green or black band mark lateral significance. Minor lighted aids which display double red bands provide for secondary landfall. Where these secondary landfall aids are also used to define lateral significance, a directional symbol (e.g. a green square - port) will be displayed between the two red bands.

NOTE: See centre colour insert for a further explanation of these types.

Lateral Significance

When proceeding upstream, fixed aids displaying a red triangular symbol in the centre of the daymark or a single red band at the top of the tower must be kept on the vessel's starboard (right) hand. Fixed aids displaying a black or green square symbol in the centre of the daymark or a single green or black band at the top of the tower must be kept on the vessel's port (left) hand side.

Fixed aids displaying an open-faced red diamond symbol in the centre of the daymark indicate a division in the channel and may be passed on either side. However, when proceeding upstream, a red triangle in the centre of the red diamond indicates that the preferred route is to the left (i.e. the aid should be kept on the vessel's starboard (right) side). Similarly, a black or green square in the centre of the red diamond indicates that the preferred route is to the right (i.e. the aid should be kept on the vessel's port (left) side).

Light Characteristics

The following are the names, abbreviations (as they appear on nautical charts), and descriptions of the basic types of light flash characters for Canadian lightstations:

NAME	ABBREVIATION	DESCRIPTION
Fixed	F	A light which appear continuous.
Isophase	Iso	A light in which the alternations of light and darkness are of equal length.
Flashing	Fl	A light in which the flash is clearly shorter than the duration of darkness (eclipse) and in which the flashes of light are all of equal duration.
Occulting	Oc	A light in which the flash is clearly longer than the duration of darkness (eclipse) and in which the intervals of darkness are all of equal duration.
Emergency Backup	Fl(6)15s	A light in which a group of 6 flashes is regularly repeated at a rate of 4 flashes per minute (every 15 seconds)

NOTE: The duration of flash and darkness of each light may vary and are advertised in the appropriate *List of Lights, Buoys and Fog Signals*. Mariners are advised that there may be more than one light flash character displayed by a lightstation (e.g. a high intensity flashing light may be superimposed on a fixed light) and thus, the *List of Lights, Buoys and Fog Signals* should be consulted to ensure proper identification.

Light Colours

The choice of light colour for fixed aids is dependent on individual site conditions (e.g. presence of background light) and the luminous range of the light colour in relation to those conditions. As a result, no set rules exist for such lights and mariners should always consult the chart to determine the function of each light.

There are, however, a few general guidelines which may be followed:

- a) Major coastal landfall lights are normally white,
- b) Green or red lights are normally used to denote port and starboard lateral significance, and
- c) Yellow lights may be used to define areas where caution should be exercised.

Any white, green, or red light may be changed to yellow without warning in situations where a new hazard necessitates the exercise of caution. An example of such a situation is where silting in results in a reduction of water depths restricting safe navigation to only small vessels.

DAYBEACONS

General

Although the majority of fixed aids display a light for night navigation, a limited number do not. These unlit aids are known as daybeacons and are used primarily to assist the mariner during daylight hours where night navigation is negligible or where it is not practicable to operate a light.

Colour, shape and possibly a number are the characteristics that identify the significance of a daybeacon to the mariner. Reflective material is applied to the daybeacons to improve their visibility and identification at night with the aid of a searchlight.

Starboard Daybeacon

A starboard hand daybeacon is triangular, with a red triangular centre on a white background and with a red reflecting border. It may display an even number made of white reflecting material. When proceeding upstream, a starboard hand daybeacon must be kept on the vessel's starboard (right) side.

Port Daybeacon

A port hand daybeacon is square with a black or green square centre on a white background and with a green reflecting border. It may display an odd number made of white reflecting material. When proceeding upstream, a port hand daybeacon must be kept on the vessel's port (left) side.

Bifurcation/Junction Daybeacon

A bifurcation/junction daybeacon marks a point where the channel divides and may be passed on either side. When proceeding in the upstream direction, a bifurcation/junction daybeacon displaying a red reflecting triangle on a white diamond with a red border indicates that the preferred route is to the left. Similarly a green reflecting square on a white diamond with a red border indicates that the preferred route is to the right. When proceeding downstream, the positions and meanings of these daybeacons are reversed.

No anchorage

A no anchorage daybeacon is square with a black anchor symbol centered on a white background with a red diagonal stripe superimposed across it. Do not anchor within the zone indicated on the chart. Area may contain submerged pipelines, power cables, etc.

RANGES

A range consists of two or more fixed navigation marks situated some distance apart and at different elevations to provide a leading line for navigators. Ranges may or may not be lighted. If lighted, the colours of the range daymarks as well as the colours and characters of the lights are advertised in the appropriate *List of Lights, Buoys and Fog Signals* publication.

FOG SIGNALS

General

Fog signals are sound producing aids that warn of dangers when visual aids are obscured by weather conditions.

Operation

Fog signals are normally operated when weather conditions are such as to reduce the visibility to less than two nautical miles. However, other values may be assigned because of local noise abatement laws or local operational requirements.

While most fog signals are operated manually or automatically by fog detection equipment in response to a low visibility condition, some fog signals may be operated continuously.

Characteristics

The mariner can identify fog signals by their distinctive sound and signal characteristics. When advertised in the appropriate List of Lights, the horn characteristics and directional positioning of the aid will be included. For example, the following may be included in the "Remarks" section of the *List of Lights, Buoys and Fog Signals*:

Horn - Blast 3 s; silence 27 s
Horn points 289 degrees

SECTOR LIGHTS

General

A sector light consists of a single light whose total luminous beam is normally divided into sectors of different colours to provide a warning or a leading line to mariners. Occasionally, a sector light will display a single colour light beam with a restricted angle of coverage (see illustration in centre insert). The colour(s) and boundaries of these sectors are indicated in the appropriate *List of Lights, Buoys and Fog Signals* publication and on marine charts.

Characteristics

When only a red sector is used within a white luminous beam, the red sector marks obstructions such as shoals.

A combination of red, white and green sectors in a luminous beam is used to provide a leading line to navigators. When proceeding upstream, the red sector indicates the starboard hand limit, the white sector indicates the recommended course, and the green sector indicates the port hand limit. When proceeding downstream the positions of the red and green sectors are reversed.

Sector Lights with Oscillating Boundaries

Some sector lights may be equipped with an oscillating boundary feature. This creates additional "boundary sectors" between solid sectors. Within these boundary sectors the rhythm of the alternating light colours will give the observer a visual indication of his position.

The most common application of this feature is with the three colour (red/white/green) leading line sector light, however, the mariner should consult the chart and other publications for the proper interpretation and usage of each light.

EXAMPLE: When proceeding upstream and crossing a 3 colour oscillating boundary sector light marking an upstream course from left to right, the observer would see, in order:

G	-	Solid Green.
AIGW	-	Green and white alternating every three (3) seconds. The duration of white would be brief when first entering the boundary sector but would become progressively longer as the observer crosses towards the white sector.
W	-	Solid white.
AIRW	-	Red and white alternating every three (3) seconds, the period of red being brief when entering the boundary sector. As the observer crosses towards the solid red sector the period of time for which red is seen increases.
R	-	Solid Red.

NOTE: Regardless of the orientation of the colours, the chart symbol (abbreviation) for a three colour sector light is always RWG.

RADIO AIDS TO NAVIGATION

RADAR REFLECTORS AND RADAR BEACONS (RACONS)

General

The detection of a radar target is essentially dependent on the level of energy reflected back into the radar receiver from the target. When an aid to navigation gives a poor radar echo, equipment may be fitted to the aid to give an enhanced echo on a radar display. There are two main methods of producing a radar enhanced target. The first is by using a passive device such as a radar reflector to enlarge the apparent echoing area of the target and the second is by the use of a radar beacon (RACON), which is an active device. RACONS can also be used to avoid confusion between radar targets that may look similar, because they produce an easily identifiable coded trace on the radar display. This feature makes RACONS effective in the marking of important or radar-inconspicuous features or structures such as gently sloping shorelines and bridge piers.

Radar Reflectors

Certain fixed shore aids and most buoys are designed or equipped to enhance the aids' ability to reflect radar signals. Radar reflectors may also be established as independent aids to navigation. Independent radar reflectors are symbolized on charts and those established on lighted aids are advertised in the appropriate *List of Lights, Buoys and Fog Signals* publication.

Radar Beacons (RACONS)

A RACON comprises three main components: a receiver, a transmitter and an antenna common to both the receiver and the transmitter. A radar within the range of the RACON interrogates the RACON each time the radar antenna points towards the RACON. The RACON receiver detects the radar interrogating the signal and triggers the RACON transmitter. The transmitter may reply with a single pulse for each trigger but normally the response consists of a series of coded pulses (Morse Code) for RACON identification. After triggering, a finite time must be allowed for the RACON to respond. This results in a transmission that is delayed in time (and range) with respect to the passive echo of the structure on which the RACON is mounted. The delay is generally equivalent to a range of less than 100 metres and, therefore, can often be disregarded at ranges greater than a few nautical miles. It is at short ranges that this error is significant. Normally, the station structure echo is visible and its range can be measured to full radar accuracy.

Radar operators may notice some broadening or spoking of the RACON presentation when their vessel approaches closely to the RACON. This effect can be minimized by adjusting the IF gain or sweep gain control of the radar (other targets will be reduced in intensity also).

CAUTIONARY NOTE: Care must be exercised in the use of the radar display controls. The RACON presentation can be virtually eliminated by operation of the FTC (Fast Time Constant) controls of the radar. The RACON replies may also be suppressed by the operation of the automatic video processor which is found in an increasing number of marine radars.

Two types of RACONS are in common use today as aids to navigation:

1. Frequency Agile RACON

This RACON is now the most commonly used RACON in Canadian waters. The Frequency Agile RACON (FAR) measures the frequency and signal strength of the interrogating radar pulse, then tunes its transmitter to that frequency before responding. This RACON provides service for X band marine radars and some installations also provide service for the marine radar band of 2920 to 3100 MHz (10 cm or S band). While it is possible for a response to be displayed on each antenna scan of every radar within range, in actual practice, these RACONS are programmed to turn off for a pre-selected period at regular intervals to prevent the masking of other echoes of interest.

2. Slow Sweep RACON

In a slow sweep RACON the transmission frequency is periodically swept through the marine radar band of 9320 to 9500 MHz (3 cm or X band). Only when the frequency passes through the narrow band width of the radar receiver is the RACON signal presented on the radar display, resulting in a short presentation time (1 to 3 antenna scans) with a long delay time (45 to 120 seconds) between presentations.

Since 1985 all RACONS purchased by the Canadian Coast Guard have been of the frequency agile type providing service to both X and S band radars. Eventually, as older units are replaced, the Canadian RACON service will consist totally of this type.

The locations, codes and operating frequencies (X, S or X and S) of RACONS are published in *Notices to Mariners* and listed in the appropriate marine publications, i.e. *Radio Aids to Marine Navigation*, *Sailing Directions* (Pilots) and *List of Lights, Buoys and Fog Signals*. The Canadian Hydrographic Service charts the Morse Code of RACONS only in areas where more than one RACON can be interrogated simultaneously.

RADIOBEACONS

The Canadian marine radiobeacon service consists of transmitter facilities operating in the frequency band from 285 to 325kHz. The characteristics of each station is a distinguishing code letter transmitted in groupings of three. Mariners should consult the *Radio Aids to Marine Navigation* publication to ensure proper identification of stations.

All Canadian radiobeacons operate in a continuous mode and provide the following categories of service:

- 1) **Landfall:** Radiobeacons having ranges from 100 to 200 nautical miles provide a means of identifying major points of land when approached from seaward.

- 2) **Homing:** Radiobeacons having ranges from 20 to 100 nautical miles provide a means of locating major harbours or ports of refuge.
- 3) **Calibration:** This is a minor service, provided by short-range radiobeacons which are operated on request to provide a means of calibrating radio direction finding equipment aboard the user's vessel.

The radiobeacons providing the first two categories (landfall or homing) of service may be either dedicated marine beacons or combined air/marine beacons; that is providing service to both air and marine users. The Canadian service is complemented by radiobeacons operated by the U.S. Coast Guard in contiguous waters.

Mariners are cautioned of the possible limitations of radiobeacons and receiving equipment. Possible errors in bearings of radiobeacons can be caused by coastal refraction, errors in calibration of direction finding equipment, and failure to correct for convergence. Attention is also drawn to the serious dangers that may arise from relying on radiobeacons in fog. No attempt should be made to home in on any radiobeacon or fog signal under any condition.

All categories of radiobeacons are shown on the nautical charts and are listed in the publications *Radio Aids to Marine Navigation* and the appropriate *List of Lights, Buoys and Fog Signals*.

NOTE: Although the Canadian Coast Guard is decreasing the number of radiobeacons in service, any Coast Guard Radio Station will, on request, transmit signals that will enable a vessel to take a bearing with its own direction finder.

LORAN-C

System Description

Loran-C is a hyperbolic radio navigation system. Such systems operate on the principle that the difference in the time of arrival of signals from two or more stations, observed at a point in the coverage area, is a measure of the difference in distance from the point of observation to each of the stations. Loran-C employs time difference measurements of signals received from at least three fixed transmitting stations. The stations are grouped to form a "chain" of which one station is labelled the master (designated M) and the others are called secondary stations (designated W, X, Y or Z).

For a given master-secondary pair of stations, a constant difference in time of arrival of signals defines a hyperbolic Line Of Position (LOP). The measurement of the received Time Difference (TD) from a second master-secondary pair results in a second LOP. The position fix is achieved by observing the intersections of the two LOP's on specially latticed Loran-C charts.

Alternatively, most Loran-C receivers sold today are equipped with microprocessors which are designed to compute and display the latitude and longitude coordinates of the receiver, based on the TDs.

CAUTIONARY NOTE: The Latitude/Longitude computation in many receivers is based upon a pure seawater propagation path. This leads to errors if the Loran-C signal paths from the various stations involve appreciable overland distances which cause the signals to travel at a slower speed. It is recommended that operators using the coordinate converter feature of their receivers check the manufacturer's operating manual to determine if and how corrections are to be applied to compensate for overland paths. For those coordinate converters that can accommodate the correction (called an Additional Secondary Factor (ASF) correction) to the Time Differences, the chartlets in the Coast Guard's *Radio Aids to Marine Navigation* publication can be used to ascertain the numeric value to apply.

For receivers without the coordinate converter facility, the data in the chartlets are irrelevant since these corrections are already accommodated in the lattices on CHS charts. On smaller scale charts the small ASF corrections, although accounted for by prediction rather than measurement, are not usually discernible.

The transmitting stations of a Loran-C chain transmit groups of pulses which are repeated at a specific interval called the "rate" or the Group Repetition Interval (GRI). Each pulse has a 100 kHz carrier frequency. The secondary stations transmit 8 pulses to a group, while the master station transmits an extra ninth pulse which is used for receiver automatic acquisition and blink alarm. The Loran-C rate structure is such that a GRI of between 40,000 and 99,990 microseconds is chosen for a chain. The GRI is used to identify a particular Loran-C chain. The designation of a Loran-C chain is by the first four digits of the specific GRI. For example, the Canadian West Coast Chain has a GRI of 59,900 microseconds and is designated Rate 5990, while the Canadian East Coast Chain has a GRI of 59,300 microseconds and is designated Rate 5930.

Range

Different Loran-C stations radiate different peak powers. These typically vary from 300 kilowatts to 2 megawatts. This results in ground wave coverage ranges in the order of 700 to 1,000 nautical miles over seawater. During periods of good propagation, this range may be greater, and during periods of high noise and interference, it may be less. The signal range from a particular station is dependent upon the transmitter power, receiver sensitivity, noise or interference levels, and losses (greater over land than over sea water) over the signal path.

Blink

It is normal for Loran-C stations to transmit a "blink" signal (turning off and on a secondary's first two pulses) whenever certain key operational parameters (output power, TDs, GRI, etc) are known, or suspected, to be out of tolerance.

The blink signal will cause most receivers to indicate, by an alarm, that the navigation data displayed may be in error.

Mariners should check equipment manuals to determine if their receivers are equipped with a Blink Alarm and, if not, should exercise caution when operating near known hazards or in narrow channels.

Receiver Installation

Proper installation of a Loran-C receiver is critical to good performance. Proper installation requires time and skill and should be done by a competent, factory-trained dealer. Antenna location, grounding, interference suppression, and receiver placement are all important.

Sources of Possible Errors in the Readings

Although Loran-C is regarded as a highly accurate system for use in navigation, errors may occur as a result of the following factors:

(i) Land Path Errors

Fixed errors are introduced when the signal path from a station passes over land. The Canadian Hydrographic Service corrects these errors when producing Loran-C latticed charts by adjustment of the hyperbolic position lines.

CAUTIONARY NOTE: The conversion to latitude and longitude provided as a feature of most receivers seldom includes accurate land path corrections and may, consequently, give a position several miles in error. It is recommended that operators using the conversion feature of their receiver check the manufacturer's operating manual to determine if and how corrections are to be applied to compensate for overland paths.

(ii) Cycle Selection Errors

Loran-C derives its high accuracy from comparing the phase of the secondary signal against that of the master. The receiver automatically selects the third cycle of the pulse from each station to make this phase comparison; the third cycle is used because it occurs early enough in the groundwave pulse to avoid skywave contamination. Within the area of good coverage, errors in cycle selection are very rare, but at longer ranges the receiver may select the fourth cycle on first acquiring a weak signal. This will cause an error in the reading of exactly 10 microseconds, moving the position line one mile or more. The likelihood of cycle selection error at long range is increased by:

- (a) Local radio interference which is frequently encountered in port.
- (b) Electrical noise/interference originating aboard the user's vessel.
- (c) Shielding of the antenna (ie. by dockside buildings).
- (d) Precipitation static, which occurs at the onset of snow flurries, rain showers or wet fog.
- (e) Icing, or a coating of dirt, on the antenna or antenna coupler.
- (f) Skywave interference by night, and particularly at dawn and dusk.
(NOTE: Skywave interference does not affect Loran-C within the area of "good coverage"; this occurs only when at longer ranges)

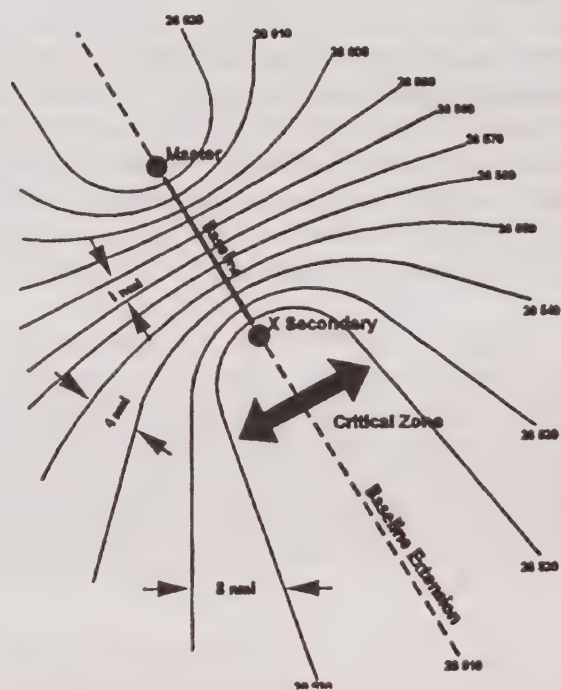
Cycle selection error is most likely to occur on the most distant station being used. If this should be the master, the result will probably be that all time difference readings will be 10 microseconds low. If the secondary is at a greater distance than the master, then it is more likely to have a cycle selection error and the corresponding time difference will be 10 microseconds high. The receiver handbook will describe the remedy once the problem station has been identified.

Initial cycle selection should be verified by an independent fix whenever possible. It is then advisable to switch the receiver into the "Tracking" mode, since the receiver will track without cycle jump to a much greater distance than that at which it will make a reliable cycle selection. Some receivers go into "Track" mode automatically upon completing cycle selection.

(iii) Baseline Extension Zone

The accuracy of the position line obtained from a particular Loran-C reading deteriorates as the ship moves from the closely spaced lattice lines in the vicinity of the baseline between the master and that particular station, towards the extension of this baseline beyond the master or the secondary station concerned. Baseline extensions are marked with a pecked line on Canadian charts. Within a zone extending about 20 microseconds each side of the baseline extension, the readings on that station pair will respond very sluggishly to a large change in position and are useless for navigation.

When crossing any baseline extension zone the reading will at some stage reach a minimum (on a secondary extension) or a maximum (on the master extension). This reading, when compared to the value marked on the charted extension line, gives a useful check on the accuracy of the system and can be used to verify cycle selection.



CAUTIONARY NOTE: Mariners should never use a master-secondary pair within 20 microseconds of a baseline extension.

(iv) Shore Proximity Errors

Both the strength of the Loran-C signal and the accuracy of the reading will change rapidly close to shore, particularly near cliffs. Local reading errors may amount to one microsecond or more. However, the error will not change, and once the Loran-C readings are known for a particular inshore passage, then they can be safely used during future transits of that passage.

As with any radio aid to navigation, there will be some locations, such as close-in under cliffs or alongside dock buildings, where the Loran-C signal cannot be received.

(v) Waypoint Navigation

Mariners are cautioned that an error can exist between the waypoint navigation information provided by their Loran-C receiver and the desired straight-line track plotted on a chart. A straight-line course plotted between two waypoints on a mercator chart is a rhumb line. However, the course and distance displayed by a microprocessor-based Loran-C receiver, when in the waypoint mode, are computed for a great circle track, not a rhumb line.

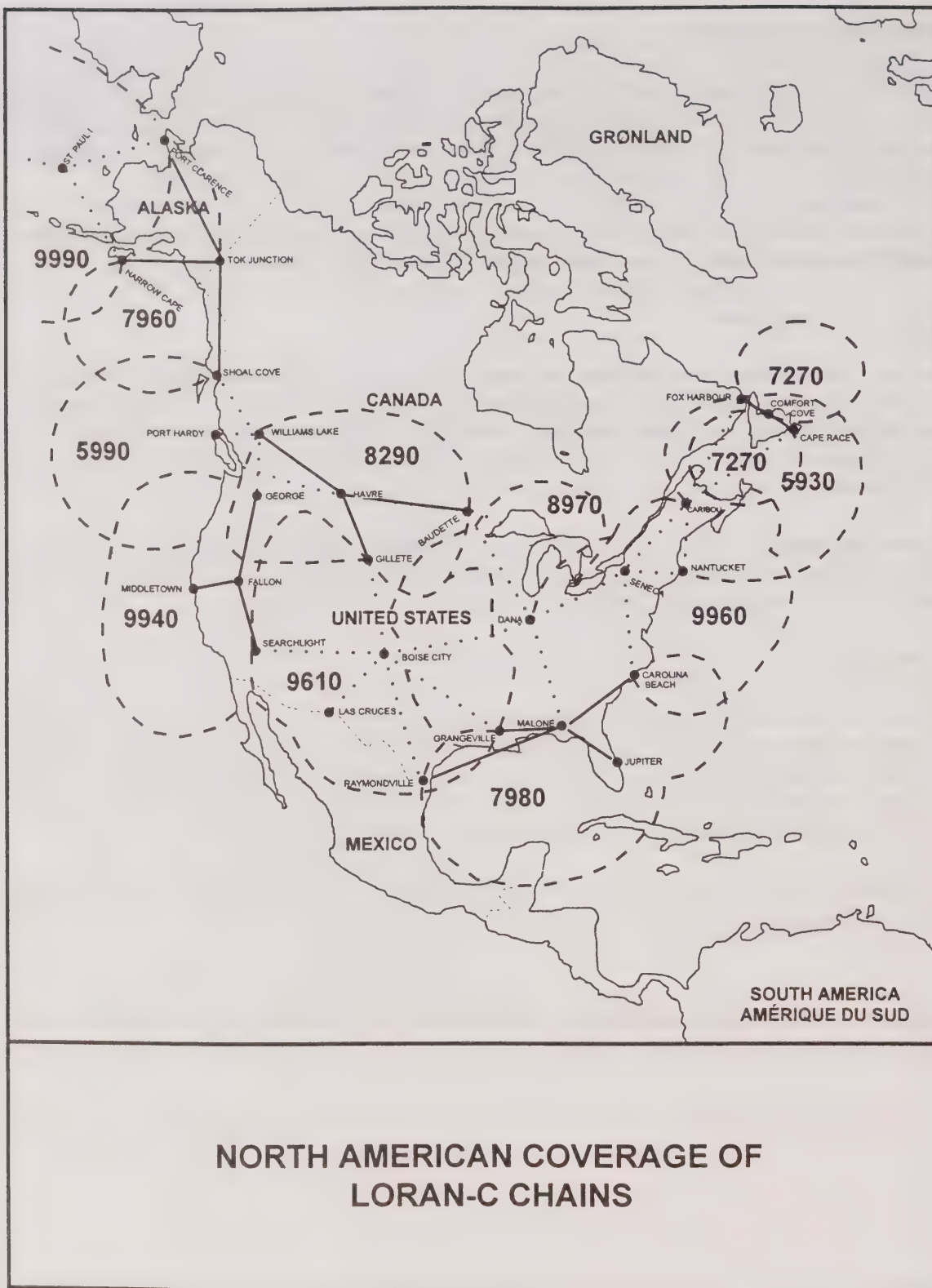
This offset distance, or error, is a maximum when sailing East-West at a latitude of approximately 45 degrees, decreasing to zero at the equator and North and South poles. It also decreases to zero as your track becomes North-South, regardless of latitude.

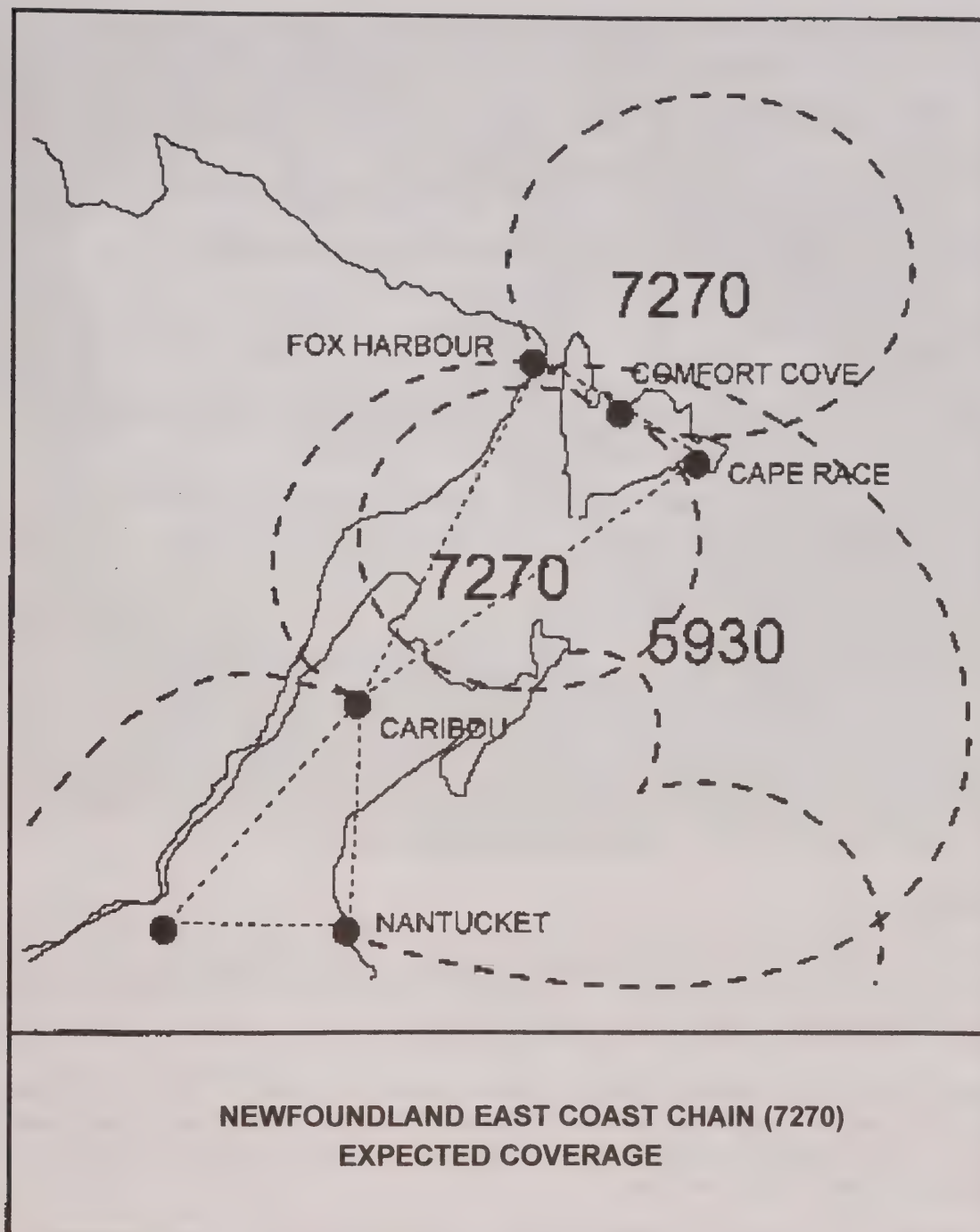
(vi) Interference

Electrical and electronic interference, or noise, can come from many sources and may be produced onboard the vessel or within the surrounding environment. Because many onboard items use frequencies that are very similar the 100 kHz frequency of Loran-C, the problem is often severe. To get good Loran-C results all onboard noise must be suppressed. Special culprits include alternators and generators, ignition system components, electric motors, and radar.

Interference suppression may require the installation of shields, grounds or capacitors and demands considerable ingenuity and determination.

NOTE: For further information on Loran-C, consult the Canadian Coast Guard publications ***A Primer on Loran-C, Loran-C Receiver and Installation Guide***, and ***Loran-C Receiver Operators Guide*** (listings on page 48).





Note: The Canadian Hydrographic Service will not be producing latticed Loran-C charts for the Southern "lobe" of the 7270 chain.

GLOBAL POSITIONING SYSTEM

On December 8, 1994, the U.S. Department of Defense made available to the Department of Transportation the Global Positioning System (GPS) Standard Position System (SPS) for civilian use. As a result, marine users, equipped with a GPS receiver can obtain a position fix anywhere in the world using satellite ranging signal broadcasts. A minimum of three satellites in view of the GPS receiver are needed to provide a two dimensional fix (latitude and longitude). A three dimensional position fix is available in all Canadian marine areas using a minimum of four satellites.

GPS receivers suitable for civil use are readily available at a moderate price.

System Description

The Global Positioning System (GPS) is a worldwide satellite based radionavigation system developed and operated by the United States Department of Defense.

In the GPS system, a transmission originates from satellites orbiting the earth. These transmissions contain information providing a receiver with precise, continuous, worldwide, all weather three dimensional position information for land, sea and air applications. Although the primary mission is to meet military requirements, GPS is also being made available without cost for civil navigation. Two levels of service are being provided, one for civilian use, (SPS) and the second for military use (PPS).

Standard Positioning Service (SPS)

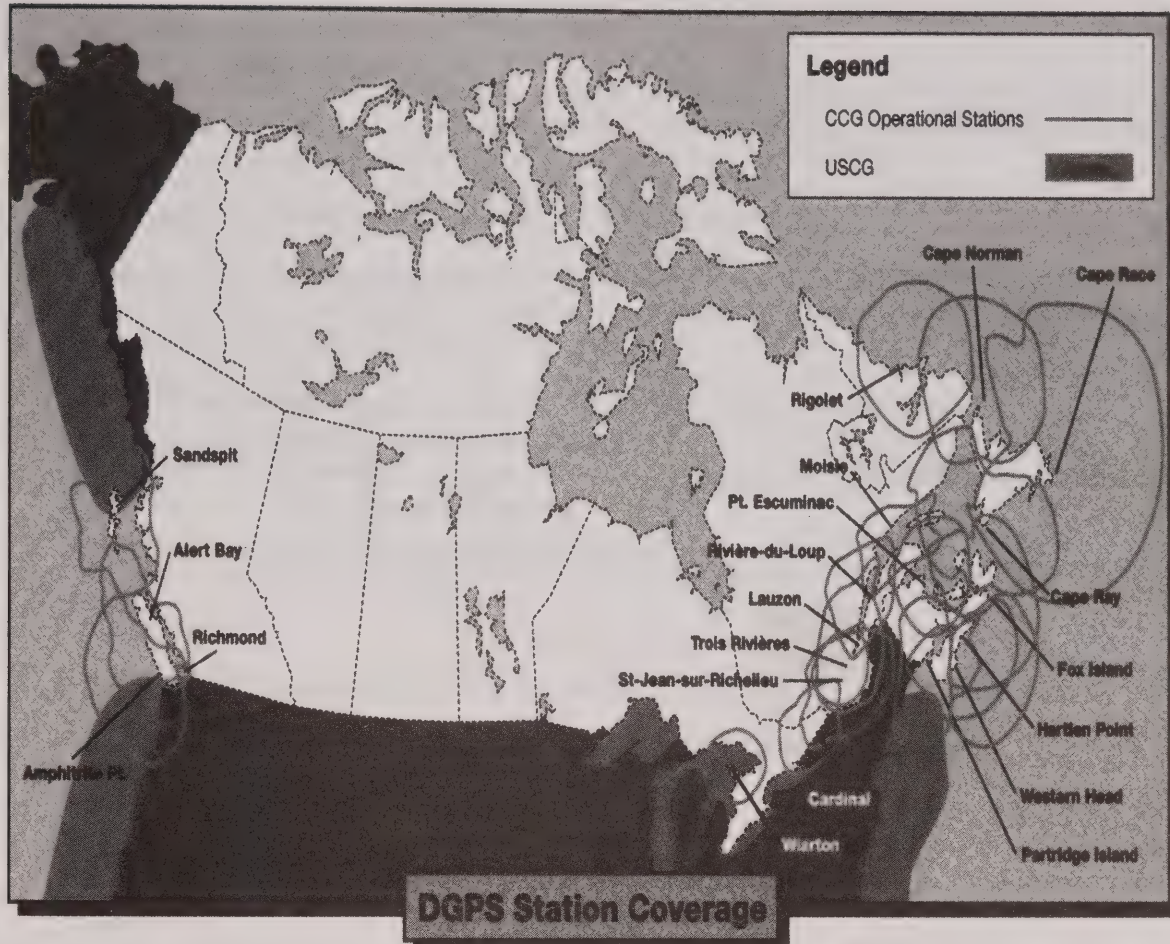
SPS is a positioning and timing service made available to all GPS users on a continuous, worldwide basis with no direct charge. SPS provides the capability to obtain horizontal positioning accuracy within 20 meters, 95% probability and 30 meters, 99.99% probability.

Current Status

With GPS operational, all of Canada's navigable waters are effectively blanketed by a continuous, all-weather, accurate positioning signal. It is capable of meeting the need of civil and marine interests in all but the most restrictive navigation situations.

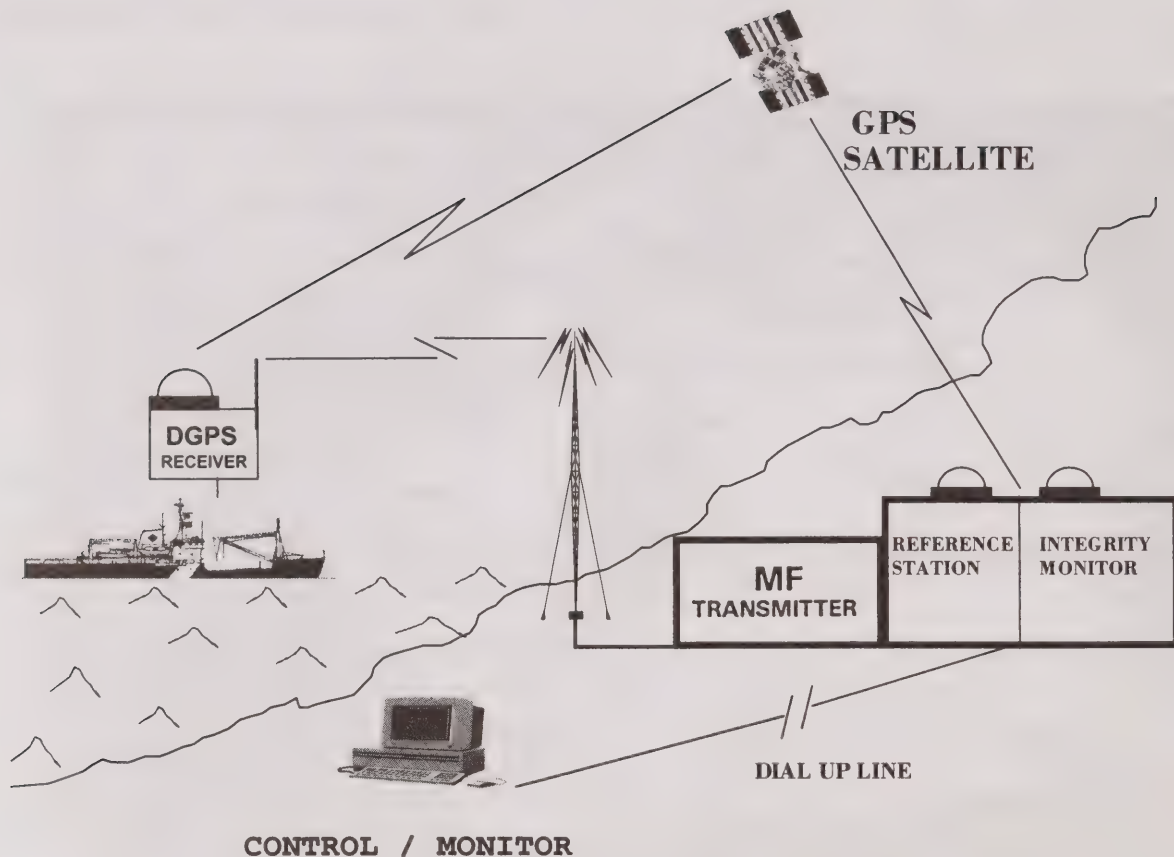
The system enables users equipped with suitable receivers, on land, at sea or in the air, to establish their position, speed and time at any time of the day or night and in any weather conditions. The system provides a level of accuracy equal to or better than any other radionavigation system available today.

Differential Global Positioning System (DGPS)



A method of obtaining greater accuracy from GPS is through a technique called Differential GPS (DGPS). This technique corrects the inherent inaccuracies of the GPS signal by comparing the position calculated by GPS to a known geographic position.

NOTE: On May 1, 2000, the intentional degradation of the GPS signal, called Selective Availability (SA) was removed.



A reference station is established at a known geodetic location and position information received from the GPS satellites is compared to this known geodetic location. Based on this information, differential corrections are generated and broadcast to the user via Marine MF radiobeacons.

Coast Guard implemented the differential service nationally in 1996 and declared the DGPS service as providing a Full Operational Service (FOS) on May 28, 2000. The Canadian DGPS service complements the United States Coast Guard system.

The system provides a positioning accuracy of 10 metres or better 95% of the time and also provides integrity monitoring. In this sense, a warning signal advising the mariner that the service is unreliable is automatically transmitted in any case where the accuracy provided by a reference station falls below established limits. Should the differential broadcast be lost or unavailable, a DGPS receiver can continue to operate in GPS mode using the SPS signal.

RELATED PUBLICATIONS AND SOURCES

RELATED PUBLICATIONS

1. **Safe Boating Guide**

A valuable source of information for all boat operators. Contains information on equipment requirements, safety practices, operating regulations and other sources of nautical information. (free) (Source E or F)

2. **Catalogues of Nautical charts and Related Publications**

Identifies the available nautical charts, explains the various categories of charts, lists local chart distributors and gives instructions for ordering. Also contains information concerning other related publications. (free) (Source B)

Catalogue 1 - Atlantic Coast (Montreal – East)

Catalogue 2 - Pacific Coast

Catalogue 3 - Great Lakes (Manitoba – Montreal)

Catalogue 4 - Arctic

A price list of all non-free Canadian publications is available on request form the CHS.

3. **Chart No. 1**

Symbols and Abbreviations used on Canadian Nautical Charts. (Source B)

4. **Charts**

Nautical charts show hazards and aids to navigation, features of the coastline, the contour of the seabed and natural and artificial features in the area. They are available in various scales. Consult the catalogues to find the chart that covers the area of interest to you. (Source B)

5. **Sailing Directions**

These publications include Sailing Directions and Small Craft Guides which give detailed descriptions of various waterways, including pictures of some harbour entrances, facilities available, etc. They are listed in the Catalogues of Nautical Charts at various prices. (Source B)

6. **Radio Aids to Marine Navigation**

Published annually in 2 volumes. Provides information concerning marine weather forecast areas and radio navigational aids services. Also lists the services provided by Canadian Coast Guard Radio Stations, vessel traffic and information services and the location and characteristics of marine radio aids to navigation, i.e. Loran-C, Radiobeacons and RACONs. (Source B)

Note: Atlantic & Great Lakes (English & French available); Pacific (English only)

7. List of Lights, Buoys and Fog Signals

Published in four volumes. Contains information on the characteristics and position of shore lights, lighted buoys and fog signals for various regions. Available in English and French at various prices. (Source B)

Newfoundland (includes coastal Labrador)
Atlantic Coast (includes Gulf & River St. Lawrence to Montreal)
Inland Waters (west of Montreal, east of British Columbia)
Pacific Coast (includes rivers & lakes of British Columbia)

Also available on the Notices to Mariners web site <http://www.notmar.com>

8. A Primer on LORAN-C

Describes the basic characteristics of the Loran-C radio navigation system and provides information on its use. (Free) (Source C)

9. LORAN-C receiver Operations Guide

This Guide gives the mariner a few helpful hints on using his Loran-C receiver so that he can derive the maximum benefit from it. (Free) (Source C)

10. LORAN-C Receiver Installation & Maintenance Guide

The information in this installation and Maintenance Guide has been collected from many sources to provide dealers, installers and owners of Loran-C receivers with a handy reference. (Free) (Source C)

11. Notes on the Use of LORAN-C charts

Provides helpful hints on the use of latticed Loran-C charts. (Free) (Source B)

12. Notices to Shipping

Radio broadcasts issued through Coast Guard Marine Radio Stations. These broadcasts contain a variety of information that affect the immediate safety of the mariner (e.g. malfunction of aids to navigation, new hazards, changes to aids). Written copies of these broadcasts are available from Coast Guard Regional Offices. (Free) (Source F for subscription)

13. Monthly Notices to Mariners

Published once a month. Contains important navigational information such as changes in aids to navigation, new hazards, amendments to nautical charts, *Sailing Directions*, the *List of Lights, Buoys and Fog Signals*, and *Radio Aids to Marine Navigation*. They also advertise publication of new charts, new printings of charts and publications and other changes to the *catalogues of Nautical Charts*. National and Regional (Newfoundland, Maritimes, Gulf of St. Lawrence and St. Lawrence river, Central, Pacific and Arctic) editions. (Free) (Source C for subscription. Electronic version available on the Notices to Mariners web site <http://www.notmar.com>)

14. Annual Notices to Mariners

Published annually at the beginning of each year. Contains information on a wide variety of subjects of concern to the mariner. Subjects covered include: (Source B)

- aids to navigation
- marine regulations
- pollution and casualties
- search and rescue
- military exercise areas
- charts and publications
- marine safety

15. Tide and Current Tables

Published annually in six volumes. Contains daily tide predictions for all Canadian reference ports along with tidal differences for secondary ports. Daily current predictions are also included for selected stations. They are listed in the Catalogue of Nautical Charts at various prices. (Source B)

- Volume 1 - Atlantic Coast and Bay of Fundy
- Volume 2 - Gulf of St. Lawrence
- Volume 3 - St. Lawrence and Saguenay Rivers
- Volume 4 - Arctic and Hudson Bay
- Volume 5 - Juan de Fuca and Georgia Straits
- Volume 6 - Barkley Sound and Discovery Passage to Dixon Entrance

16. Provincial Directories of Safe Boating Courses

Directories listing recreational boating organizations and fisheries colleges throughout each province and describes the courses they offer on safety, instructor training and skills development. Please indicate the province and official language (English or French) requested. (Free) (Source E and F)

17. Directory of Safe Boating information

This directory lists safe boating information (pamphlets, videos, educational tools, etc.) and describes their content, language, costs and where they may be obtained. (Free) (Source E and F)

18. Collision Regulations

Describe the conduct to be followed by every vessel in any waters, in order to avoid collision. Also details the requirements for the carriage of navigational aids, such as lights and sounding appliances, and the standards with which such equipment is to be in compliance. (Source D)

19. Private Buoy Regulations

The *Private Buoy Regulations* describe the colour, shape, size and markings required for each buoy as well as the responsibilities of the person(s) placing them. These Regulations also describe Coast Guard's authority to order the repair of any buoy or remove any interfering or misleading buoy. Anyone contemplating placing a private buoy in Canadian waters should obtain a copy of these regulations. (Source D)

20. Boating Restriction Regulations

Define the authority and conditions for restrictions relating to the presence, activity, speed and sizes of vessels in Canadian waters. This includes regulation of such activities as regattas, boat races and marine parades as well as the placement, treatment and removal of restrictive signage. (Source D)

21. Charts and Nautical Publications Regulations (1995)

Although not mentioned in the "Related Publications" section of this text, these regulations outline the requirements for carrying the appropriate nautical charts and publications while operating any vessel. (Source D)

22. An Owner's Guide to Private Aids to Navigation

Provides a useful informational tool to be used in conjunction with the establishment, operation and maintenance of a private aid to navigation. Incorporates useful insights into such areas as related legislation, buoy construction, owner responsibility, buoy mooring, and maintenance requirements. (Free) (Source C or F)

23. GPS / DGPS Made Easy

Provides mariners with a basic understanding of the Global Positioning system (GPS) and the Differential Global Positioning system (DGPS). (Free) (Source C or F)

24. Primer on GPS and DGPS

Provides a technical overview of the Global Positioning system (GPS and the Differential Global Positioning system (DGPS). (Free) (Source C or F)

Note: The price for all non-free publications is available on request from CHS.

SOURCES OF RELATED PUBLICATIONS

A. Communications Directorate
Department of Fisheries & Oceans
200 Kent Street
Ottawa, Ontario
K1A 0E6

B. Canadian Hydrographic Service
Department of Fisheries & Oceans
Ottawa, Ontario
(613) 998-4931
Web site: <http://www.charts.gc.ca>

NOTE: Charts and related publications are also available from local authorized distributors. Consult the list of authorized distributors in the chart catalogue to find the seller nearest you.

C. Navigation Systems Branch
Canadian Coast Guard
Centennial Towers
200 Kent Street
Ottawa, Ontario
K1A 0E6

D. Canadian Government Publishing – PWC / GSC
Ottawa, Ontario
K1A 0S9
1-800-635-7943
(819) 956-4800

E. Office of Boating Safety
Canadian Coast Guard
Centennial Towers
200 Kent Street
Ottawa, Ontario
K1A 0E6

F. Any Canadian Coast Guard Regional Office.
(see listing on page 54 to 56)

PROVINCIAL CONTACTS – BOATING RESTRICTION REGULATIONS

BRITISH COLUMBIA

Canadian Coast Guard
Office of Boating Safety
25 Huron Street
Victoria, British Columbia
V8V 4V9

MANITOBA

Department of Natural Resources
Policy Coordination Branch
Box 38, 200 Salteaux Crescent
Winnipeg, Manitoba
R3J 3W3

ONTARIO

Ministry of Natural Resources
Natural Heritage Section, S5
300 Water Street
Peterborough, Ontario
K9J 8M5

NOVA SCOTIA, NEW BRUNSWICK and PRINCE EDWARD ISLAND

Canadian Coast Guard
Office of Boating Safety
P.O. Box 1000
Dartmouth, Nova Scotia
B2Y 3Z8

ALBERTA

Department of Environmental Protection
Fish and Wildlife Services
Enforcement Program
Main Floor, South Tower, Petroleum Plaza
9915-108th Street
Edmonton, Alberta
T5K 2G8

SASKATCHEWAN

Saskatchewan Department of Environment
and Resource Management
Provincial Enforcement Section
P.O. Box 3003
Prince Albert, Saskatchewan
S6V 6G1

QUEBEC

Judicial Services
Ministry of Municipal Affairs
20 Chauveau Avenue
Quebec, Quebec
G1R 4J3

NEWFOUNDLAND

(Northwest Atlantic Fisheries Centre)

Canadian Coast Guard
Office of Boating Safety
P.B. Box 5667
St-John's, Newfoundland
A1C 5X1

CANADIAN HYDROGRAPHIC SERVICE – REGIONAL OFFICES

HEADQUARTERS

Director, Marine Cartography
Canadian Hydrographic Service
Fisheries and Oceans
615 Booth Street, Room 314
Ottawa, Ontario
K1A 0E6

SCOTIA – FUNDY

Director Hydrography
Scotia-Fundy Region
Canadian Hydrographic Service
Department of Fisheries and Oceans
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

CENTRAL and ARCTIC

Director, Hydrography
Central and Arctic Region
Canadian Hydrographic Service
Department of Fisheries and Oceans
Canada Centre for Inland Waters
P.O. Box 5050
867 Lakeshore Road
Burlington, Ontario
L7R 4A6

NEWFOUNDLAND

Director
Canadian Hydrographic Service
Newfoundland Region
Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland
A1C 5X1

QUEBEC

Director, Hydrography
Québec Region
Canadian Hydrographic Service
Department of Fisheries and Oceans
Institut Maurice Lamontagne
P.O. Box 1000
850 Route de la Mer
Mont-Joli, Québec
G5H 3Z4

PACIFIC

Director, Hydrography
Pacific Region
Canadian Hydrographic Service
Department of Fisheries and Oceans
Institute of Ocean Sciences
P.O. Box 6000
9860 West Saanich Road
Sidney, British Columbia
V8L 4B2

CANADIAN COAST GUARD AIDS TO NAVIGATION OFFICES

(B) Bilingual Service
(E) English Only Service

(TF) Toll Free
(H/N) Holidays & Nights

Newfoundland Region:

ST. JOHN'S NFLD

SUPERINTENDENT, AIDS TO NAVIGATION

NAFC, White Hills

P.O. Box 5667

St. John's, Newfoundland

A1C 5X1

Tel: 1 (709) 772-5195 (E)

Regional Operation Centre: 1-800-563-9089 (B)(H/N)(TF)

Maritimes Region:

DARTMOUTH, N.S.

REGIONAL DIRECTOR

P.O. Box 1035

176 Portland St.

Dartmouth, Nova Scotia

B2Y 1J3

Tel: 1 (902) 426-3907 (B)

SUPERINTENDENT, AIDS TO NAVIGATION

P.O. Box 1000

Dartmouth, Nova Scotia

B2Y 3Z8

Tel: 1 (902) 426-3151 (E)

1-800-565-1633 (B) (TF)

CHARLOTTETOWN, P.E.I.

AIDS TO NAVIGATION OFFICER

P.O. Box 1236

Charlottetown, P.E.I.

C1A 7M8

Tel: 1 (902) 566-7936 (B)

1-800-565-1633 (B)(TF)

Maritimes Region (continued):

SAINT JOHN, N.B.

AIDS TO NAVIGATION OFFICER

P.O. Box 700

Saint John, New Brunswick

E2L 4B3

Tel: 1 (506) 636-4703 (E)

1-800-565-1633 (B)(TF)

Laurentian Region:

QUÉBEC CITY, QUÉBEC

SUPERINTENDENT

101 Champlain Blvd.

Québec, Québec

G1K 7Y7

Tel: 1 (418) 648-3574 (B)

Montreal Office: 1-800-363-4735 (B)(TF)

Internet: aidesnavquebec@fdfo-mpo.gc.ca

Central and Arctic Region:

SARNIA, ONTARIO

REGIONAL DIRECTOR GENERAL

201 North Front Street, Suite 703

Sarnia, Ontario

N7T 8B1

Tel: 1 (519) 383-1800 (E)

Operations Centre: 1 (519) 383-1841 (B)(H/N)

Regional Superintendent of Aids to Navigation: 1 (519) 383-1859 (E)

PARRY SOUND, ONTARIO

SUPERVISOR, AIDS TO NAVIGATION

P.O. Box 310

Parry Sound, Ontario

P2A 2X4

Tel: 1 (705) 746-2196 (E)

Central and Arctic Region (continued):

PRESCOTT, ONTARIO

SUPERVISOR, AIDS TO NAVIGATION
P.O. Box 1000
Prescott, Ontario
K0E 1T0
Tel: 1 (613) 925-2865 (E)

HAY RIVER, N.W.T.

SUPERVISOR, AIDS TO NAVIGATION
P.O. Box 5002
Hay River, N.W.T.
X0E 0R0
Tel: 1 (403) 874-5501 (E)

Pacific Region:

VANCOUVER, B.C.

DIRECTOR, MARINE AIDS PROGRAM
300-555 West Hastings Street
Vancouver, B.C.
V6B 5G3
Tel: 1 (604) 775-8852(E)

VICTORIA, B.C.

SUPERINTENDENT, AIDS TO NAVIGATION
25 Huron Street
Victoria, B.C.
V8V 4V9
Tel: 1 (250) 480-2600 (B)

UNITED STATES

Aids to Navigation, Boating Information

U.S. Coast Guard publications concerning aids to navigation may be obtained at all U.S.C.G. District Offices or by writing:

U.S. Coast Guard Headquarters (GNSR)
2100 Second Street, SW
Washington, DC 20593
USA
Tel: (202) 267-2229

Charts

U.S. charts may be purchased from local distributors in both the United States and Canada.

National Ocean Service nautical chart catalogues and lists of sales agents (in the U.S. and Canada) are available (free) by writing:

National Ocean Service
6501 Lafayette Avenue
Riverdale, MD 20737-1199
USA
Tel: (301) 436-8301

U.S. charts and related publications may also be purchased from the above address. Mail orders must be accompanied by a cheque or money order payable (in U.S. funds). For more information please call the number above.

The limits and numbers of U.S. charts along the St. Lawrence Seaway and throughout the Great Lakes can also be found in Canadian Hydrographic Service Chart Catalogue 3.

